SCIENTIFIC AMERICAN

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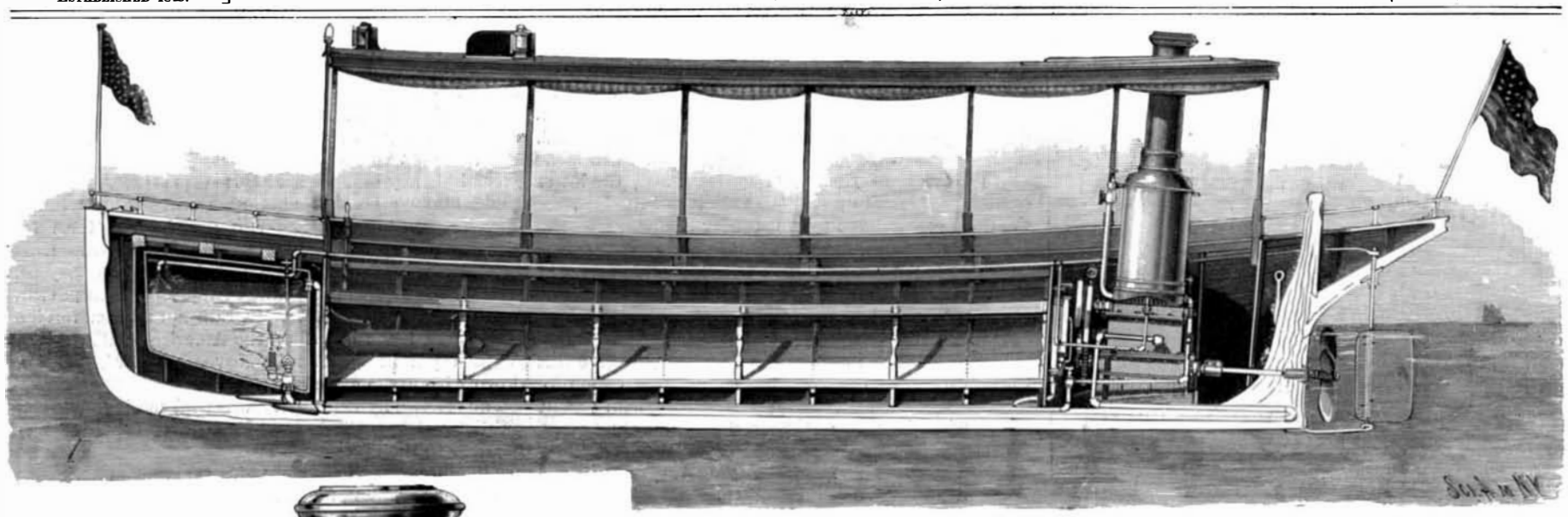

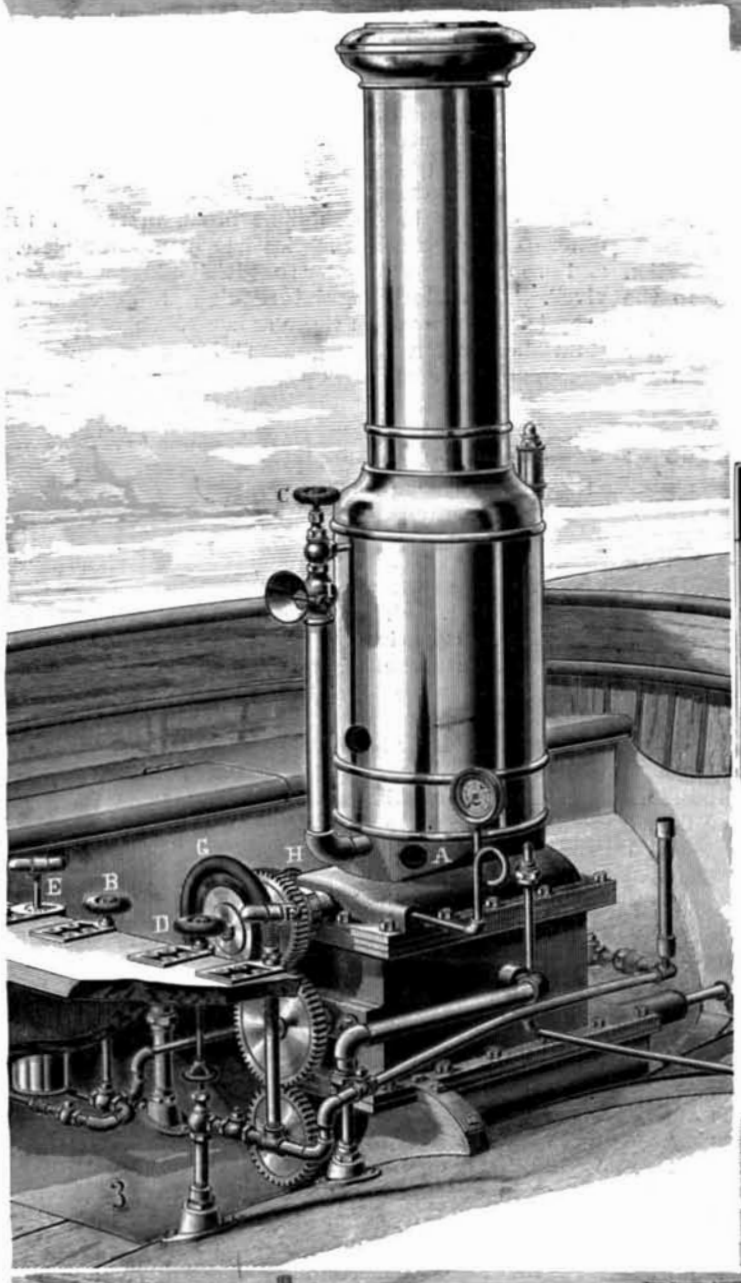

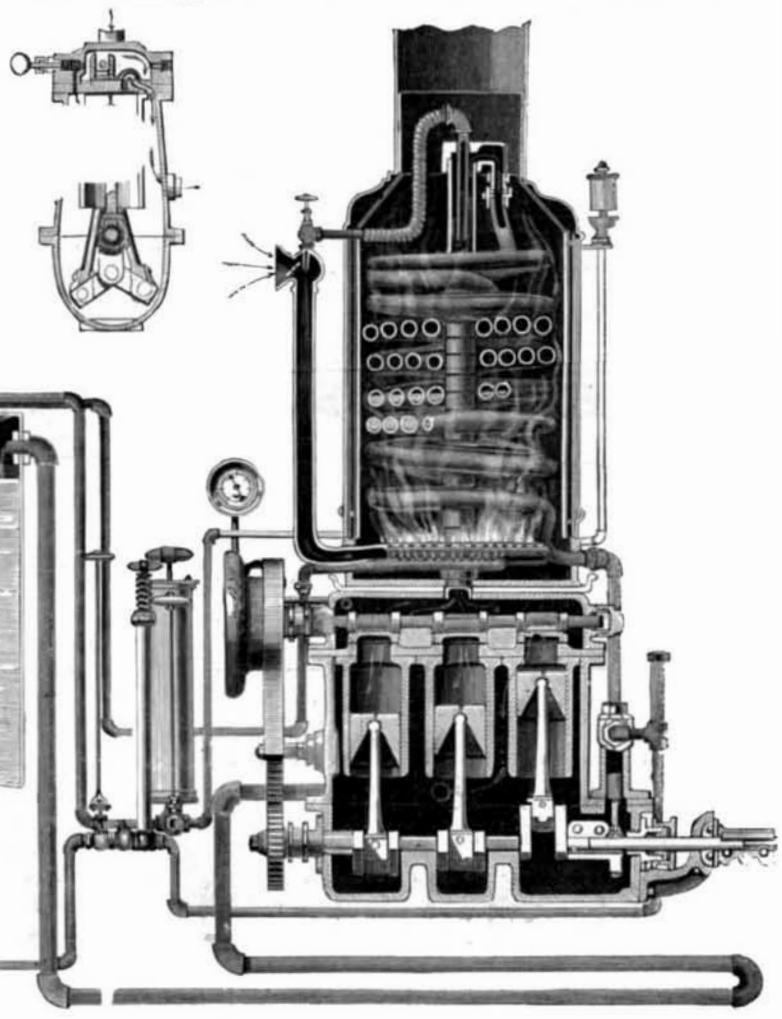

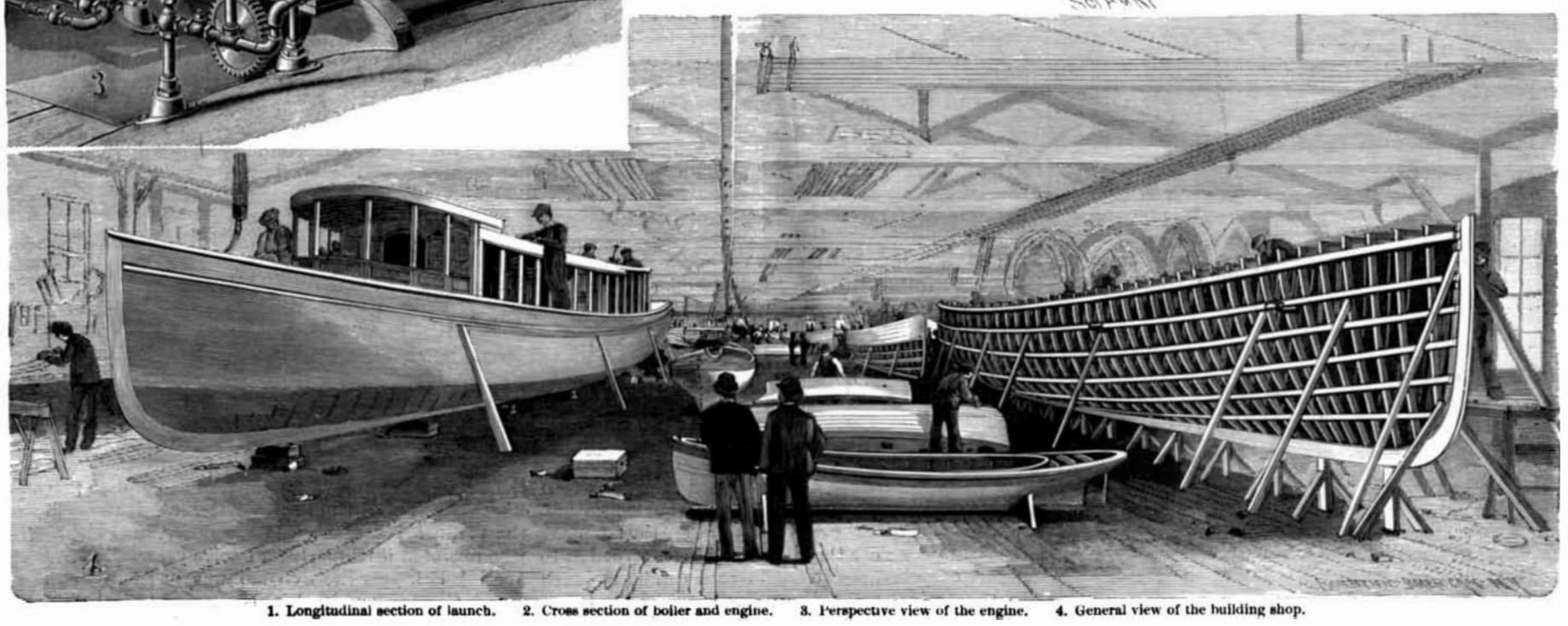

1. Longitudinal section of launch. 2. Cross section of boiler and engine. 3. Perspective view of the engine. 4. General view of the building shop.

THE MANUFACTURE OF NAPHTHA LAUNCHES BY THE GAS ENGINE AND POWER COMPANY—[See page 167.]

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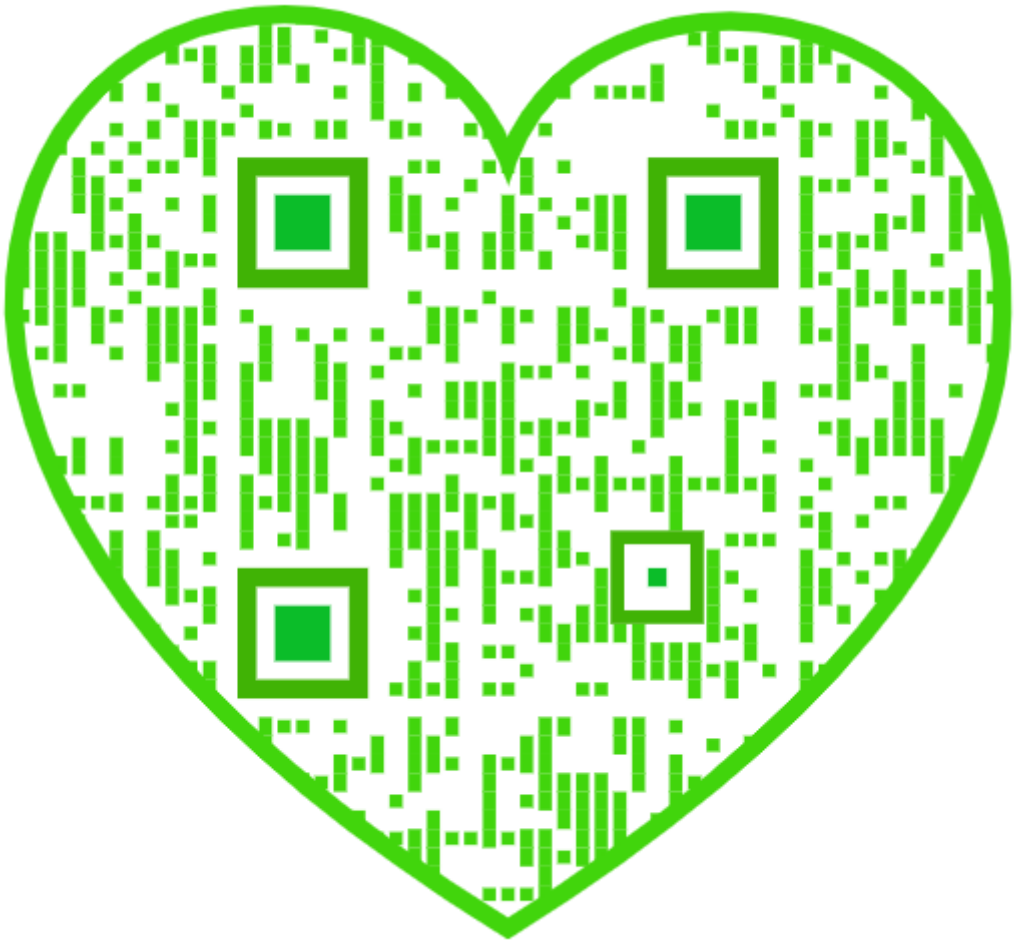

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AN IMPORTANT PATENT DECISION BY THE SUPREME COURT.

Section 4887 of the Revised Statutes of the United States, relating to patents, contains the following provision: "Every patent granted for an invention which has been previously patented in a foreign country shall be so limited as to expire at the same time with the foreign patent, or, if there be more than one, at the same time with the one having the shortest term, and in no case shall it be in force more than seventeen years."

In some countries, as, for example, Great Britain, the life of a patent is 14 years; if therefore an invention is first patented there, and afterward patented here, the American patent will only run for 14 years. The term of the American patent is thus reduced by three years, simply because the foreign patent was taken out prior to the American patent. There is no important reason why the American patent should be thus shortened, and it seems to be a palpable injustice; but such is the plain provision of the American law, and the lower courts have always upheld the validity of the law.

Various efforts have been made by interested parties to procure decisions holding the meaning of the statute to be that when patents are granted in foreign countries *prior to the filing of the application* for the American patent, such American patents should expire with the shortest foreign patent.

The lower courts have invariably refused to give this interpretation to the statute; they held to the provision of the text, namely, that the American patent expired with the term of the shortest foreign patent.

The question has now been, for the first time, authoritatively settled by the Supreme Court of the United States, the case being that of the Bate Refrigerating Company, appellant, vs. Sulzberger. Bate applied for his American patent December 1, 1876, and it was granted in November, 1877. But prior to the issue of this patent he took a Canadian patent (July 9, 1877) for the term of five years; also an English patent (January 29, 1877).

The decision of the Supreme Court was delivered by Judge Harlan, on March 4, 1895.

"We cannot," says the Court, "superadd in Section 4,887 of the Revised Statutes the words 'prior to the application' either after the words 'first patented or caused to be patented in a foreign country,' or after the words 'previously patented in a foreign country,' without deviating from the intention of Congress as manifested by the language it selected to indicate its purpose. And the express command of the existing statute is that every American patent for an invention 'previously patented in a foreign country,' that is, 'first patented or caused to be patented in a foreign country,' shall expire at the same time as the foreign patent. No words are used that will justify the Court in holding that an invention patented in a foreign country before being patented here is to be exempt from the operation of the provision limiting the term of the American patent to expire with the foreign patent.

"Was the Bate invention patented abroad before it was patented in this country? If so, the American patent expired with the foreign patent, and therefore the American public became entitled to use the invention from the time the foreign public were permitted to use it. Congress in effect by the existing law says to the inventor in order to enjoy the exclusive use in this country of his invention for the term prescribed by law, 'if your invention has not been introduced into public use for more than two years you may, upon complying with the conditions prescribed, obtain an American patent, and you may, if you can, obtain a foreign patent. But the American patent will be granted on the condition that if you obtain a foreign patent first your invention shall be free to the American people whenever by reason of the expiration of the foreign patent it becomes free to people abroad; but in no case shall the term of the American patent exceed seventeen years.' This we deem to be a sound interpretation of the statute giving to the words used the meaning required by their ordinary signification. In our judgment the language used is so plain and unambiguous that a refusal to recognize its natural meaning would be justly regarded as indicating a purpose to change the law by judicial action based upon the supposed policy of Congress. But as this court well said in Haddon vs. Collector, 5 Wall. 107: 'What is termed the policy of the government with reference to any particular legislation is generally a very uncertain thing, upon which all sorts of opinions are founded by different persons. It is a ground much too unstable upon which to rest the judgment of the court in the interpretation of statues.' 'Where the language of the Act is explicit' this court has said 'there is great danger in departing from the words used to give an effect to the law which may be supposed to be designed by the legislature. . . . It is not for the court to say where the language of the statute is clear that it shall be so construed as to embrace cases because no good reason can be assigned why these were excepted from its provisions.' Denn. vs. Reid, 10 Pet. 524-527.

"Our answers therefore to the questions certified are that the invention for which United States patent to Bate was issued under the facts stated, was 'previously patented in a foreign country,' within the meaning of those words in Section 4,887 of the Revised Statutes, and that the United States patent to him expired under the terms of that section before the expiration of seventeen years from its date.

"Let it be so certified to the Circuit Court of Appeals."

The Bate appeal case was notable for the great array of legal talent on each side.

The General Electric Company, as owners of the Edison electric light patent, and the American Bell Telephone Company, owners of telephone patents, had great interests at stake, and were strongly represented.

Edison's patent for electrical lamps number 223,898, dated January 27, 1880 (application filed November 4, 1879), gave to its owners a virtual monopoly of the great industry of electric lamp manufacture. No one could make an electric lamp without paying tribute. This patent if allowed to run for the full term for which it was granted, namely, seventeen years from its date, would not have expired until January 27, 1897. But prior to the grant of his American patent, to wit, in November, 1879, Mr. Edison obtained foreign patents of less term than the American patent. His English patent expired in November, 1894, carrying down with it the American patent.

The electric light industry was thus made free to the public; yet few will deny that a great injustice has resulted to the inventor. To Thomas Alva Edison we are indebted for the modern electric lamp and the incandescent system of electric lighting. Every electric lamp that gleams in every corner of the world is due to the light of his genius, and he deserves well of all the nations of the earth. Although by the terms of the American statute Edison's patent is cut short, it is still within the power of Congress, makers of the law, to revive and extend the patent for an additional term of years. This has been done often, in respect to other patents, but the practice has become obsolete, and probably it were better that it should not be revived. The national legislature might, however, with propriety, bestow upon Edison some token of a substantial character, in recognition of the incalculable benefits he has conferred upon his native land.

Besides the Edison lamp patent, the hopes of several other holders of important patents are crushed by this decision of the Supreme Court. Among them are the Edison patents of 1892, covering the use of carbon in telephone transmitters; also the Berliner patent, all owned by the American Bell Telephone Company. These patents contain broad and sweeping claims.

The American patents for these inventions were not issued until 1892, although they were applied for some 14 or 15 years previously. Their issue was purposely kept back until the original Bell patent had nearly expired; they were then brought forward with the expectation of perpetuating the Bell telephone monopoly until November 17, 1908. But, as the same inventions were patented in Great Britain and other countries long prior to the issue of the American patents, the latter were null when they were granted, and their issue by our Patent Office was, in the light of the above decision, an error.

The Bell telephone monopoly is now brought to an end, so far as basic patents are concerned; and we may soon look for great improvements if not for a complete revolution in the art of electric communication throughout the country. At present it is much more expensive to communicate by telephone with distant places than it is to send telegraphic messages, but the latter consume much more time. For example, our experience is that it generally requires three hours or more to send a telegraphic message from New York to Washington and get a prompt answer back, cost fifty cents; whereas, to convey the same message by telephone and get the answer rarely takes more than ten minutes, but costs $2.00. The reason of this greater cost is that the Bell Telephone Company is bound by agreement with the Western Union Telegraph Company not to engage in telegraphic business. But this agreement, it is understood, expires this year, and thereafter the Bell Company will be able to throw more fully open to the public its remarkable facilities for telegraphic communication.

Brush's First Arc Light Machine.

At the recent Cleveland Convention the Brush Electric Company had one of the most interesting exhibits. A notable feature of the exhibit was the first arc light dynamo built by Mr. Brush. This is a one light machine, and was built in 1876, at Mr. Brush's residence, and hauled, in the rear of his buggy, to the works of the Telegraph Supply Company, in Champlain Street, where it was set up and run. Later on it was sold to the Viaduct Manufacturing Company, at Baltimore, who operated it regularly for twelve years. During the World's Fair year the dynamo was purchased by the Brush Company and exhibited as a historical relic in Electricity building, where it was shown in operation.

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Sir Henry Rawlinson.

Major-General Sir Henry Creswicke Rawlinson died in London March 5. He was born at Chadlington, Oxfordshire, in 1810, and was educated at Ealing School. In 1826 he entered the military service of the East India Company. For six years he served in Bombay and distinguished himself as a sportsman. In 1833 he accomplished the remarkable feat of riding 72 miles in 3 hours 17 minutes. In November of the same year he was sent to Persia, where he held several important positions under the Shah and reorganized the Persian army. As a soldier and diplomat he occupied many important positions with credit to himself and his country; but he owes his fame chiefly to his archæological researches, which were of pre-eminent importance. Rawlinson and Layard stood at the head of the English school of archæologists. The light which Rawlinson threw upon the cuneiform inscriptions, the barrier hitherto impassable for all European and Asiatic experts, has justified the title with which he has been honored, of the "Father of Assyriology." His researches on the cuneiform inscriptions began in 1835, and in 1837 he succeeded in copying the first column of the great Behistun inscription, and submitted a report thereon to the Asiatic Society in London, on January 1, 1838. The task of copying the Behistun inscription was one of great danger. The cuneiform characters were inscribed on a cliff over 300 feet from the ground. For support the transcriber had to trust himself to a ladder resting on a ledge about two feet in breadth. In 1843 he again made valuable researches on the inscriptions and in 1844 he completed his work on the Behistun inscription. A few years later he was commissioned by the trustees of the British Museum to superintend the excavations at Nineveh and Babylon. The results of these works were afterward published by him as "Outlines of the History of Assyria as Collected from the Inscriptions Discovered by A. H. Layard in the Ruins of Nineveh" and "On the Inscriptions in Assyria and Babylonia."

Sir Henry Rawlinson received many marks of distinction from the British government and from scientific and literary bodies. The University of Oxford conferred the much-coveted degree of D.C.L. upon him. He was a fellow of the Royal Society, a corresponding member of the French Institute, a trustee of the British Museum, the Royal Asiatic Society and the Royal Geographical Society.

Besides his numerous contributions to the journals of Asiatic societies and the works mentioned above, Sir Henry published "Memorandum on the Publication of the Cuneiform Inscriptions of Western Asia;" jointly with George Smith, "A Selection from the Miscellaneous Inscriptions of Assyria;" in conjunction with Norris, "The Cuneiform Inscriptions of Western Asia." He also made several contributions to the notes on the translation of Herodotus, published by his brother, the Rev. George Rawlinson. Perhaps his work which is best known to general readers is "England and Russia in the East," a series of papers on the political and geographical condition of Central Asia.

High Railway Speeds.

From an article in the Railroad Gazette we abstract the following: The first famous record of engine 999 was made May 9, 1893, hauling 362,000 pounds of cars and passengers, the engine and tender weighing 204,000 pounds, the total weight of train being 283 short tons. This train ran on that trip 69 miles in 63 minutes, and during this part of the run made 5 miles in 3½ minutes, or at the rate of 85·7 miles an hour on a descending grade of about 20 feet per mile. During the same run one mile was made in 35 seconds, or at the rate of 102·8 miles an hour. The speed was taken between mile posts with a stop watch by the conductor of the train. Mr. William Buchanan, the designer of the engine, who is certainly not a careless man in such matters, accepted this record as accurate. But if there had been an error of a whole second, which might easily have happened, the rate would still have been 100 miles an hour for one mile. We have, therefore, considered it safe to say that this engine has undoubtedly made as fast time as 100 miles an hour for one mile.

Concerning the record of upward of 112 miles an hour we have always had doubts, and yet we have little doubt that that run was made at even a higher speed than the record which we do accept. On May 19, 1893, engine No. 903, of the New York Central, with the same train as was hauled by No. 999, is said to have made five miles on the same ground; that is, on a descending grade of about 20 feet to the mile in three minutes, or at the rate of 100 miles an hour.

Before this time there were five records running from 87·8 miles an hour up to 97·3 on the Philadelphia & Reading and the Central of New Jersey, made in 1890, 1891 and 1892. Three of these records, including the highest one, were made by engine No. 385, a Baldwin four-cylinder compound. There is a circumstantial record of over 85 miles an hour made July 17, 1893, by the compound locomotive No. 680 with a five-car train. A distance of 13·5 miles was run in 9½ minutes, or at 85·25 miles an hour. The grade is broken, but is descending nearly the whole distance, varying from 6 feet to 37 feet per mile, with a very short bit of rising grade near the end. The times were taken to the nearest half-minute, and they are, therefore, subject to considerable correction, which might easily reduce the average speed to 80 miles. So we do not attach great value to this as an instance of over 84 miles an hour.

There can, however, be no doubt that speeds of over 84 miles an hour are often made by the Philadelphia & Reading and Central New Jersey engines. A practical designer and builder of locomotives in large practice and with a good deal of experience in timing locomotives, says that "between Jersey City and Philadelphia it is a very common occurrence for the engines hauling the Blue Line trains to reach 90 miles an hour, the seconds per mile ranging from 38 to 45. It has been my pleasure to time these engines repeatedly at a rate of 40 seconds a mile, and I have taken indicator diagrams from them at a speed of 92 miles per hour."

Arts and Industries that did not Exist Fifteen Years Ago.

"Right here in the Patent Office you may watch the forward rush of civilization and realize how rapid it is," said Chief Examiner Greely to a writer for the Washington Star. "Probably it has never occurred to you to consider how many arts and industries that are of importance to-day were unknown in 1880. Their creation has given employment to tens of thousands of people and to billions of dollars of capital. If we were thrown back only so far as a decade and a half, we should find ourselves deprived of numerous comforts, and even necessaries, as we now regard them, which were not obtainable at all fifteen years ago.

"The self-binding harvester is new since 1880, commercially speaking. It renders possible the gathering of certain cereal crops with a rapidity unapproachable by hand labor. Hundreds of thousands of men would be required to reap the harvests of the great Northwest without the aid of this machine. It has made practicable the raising of crops far larger than could be produced and garnered otherwise. Incidentally food has been cheapened.

"The typewriter was not put on the market until 1883. It seems wonderful that we could have got along at all without it. In eleven years from $25,000,000 to $30,000,000 worth of typewriters have been sold. This machine has opened a new field for women's work. It has increased the demand for writers of shorthand very greatly. The quantity of matter actually written has been enormously increased by this invention. It has rendered letter writing so easy that many people now maintain a large correspondence who would write very few letters by longhand. Merchants write more than twice as many letters as they used to, and the volume of the mails has been proportionately augmented.

CABLE AND ELECTRIC ROADS.

"Who, in 1880, had ever heard of a 'gripman' or 'motorman'? The cable and electric roads are new since then. The cost of constructing and equipping them is mainly for labor, and in this way employment has been given to great numbers of men. These novel systems of traction have given work to regiments of honest fellows who now wear uniforms. When horse cars are superseded by electricity or the cable, the number of passengers carried is always greatly increased and more cars are run, requiring a larger number of employes. The labor at the power houses is better paid than at the stables.

"The last fifteen years have witnessed the creation of the electric light, the electric railway, the telephone, and a large variety of industries depending on electricity. The inventions on which they are based have deprived nobody of employment. On the contrary, they have opened entirely new fields and fresh demands for labor. Without the aid of our patent system, which holds out to the inventor the prospect of reward, how many of these new ideas, which represent the forward steps of civilization, would remain without fruit, if not unthought of?

"The two most important of very recent inventions are the typemaking machine and the cash register. The latter has already put on the market $15,000,000 or $20,000,000 worth of material, the cost of which is mainly labor. Let me not forget to mention in the list of novel industries the manufacture of the bicycle, which is new, commercially, since 1880."

A Wire Rope Tramway at Gibraltar.

A wire tramway is stated to have lately been put up at Gibraltar for connecting the signal station at the top of the rock with the lower town. It takes up all the materials necessary tor the service of the fortress in less than five minutes, whereas formerly a whole day was required for cartage by a rough and difficult road. The engine house is erected at the north end of the Alameda, whence start two ropes 320 yards long, which lead to the top of the mountain. A powerful engine gives motion to the ropes carrying the tubes, one of which rises while the other descends. The ropes are calculated for a load of more than 70 tons; but they never have to support more than a twelfth of that weight.

Useful Products from Tar.

J. H. W. Stringfellow's process, London, is as follows: The tar, say 1 ton weight to be treated, is put into a suitable vessel and about 1 per cent of an alkali or other saponifying agent is then added and the compound well mixed with 1 ton of water. Before the water has time to separate from the tar, about one-fifth of a ton of petroleum oil of sp. gr. 0·820 is added and slowly stirred into the tarry compound until the free oil becomes of a reddish color. It will then be found that the compound has been separated into three parts, namely: (1) A red oily extract of light gravity, not miscible in water; (2) a substance of soft unctuous pitch, containing some water and resembling Stockholm pitch in appearance and general characteristics; and (3) a discolored, watery liquor. While the separating action is progressing, the light oily extract and the water can be drawn from the vessel, so as to promote the exudation from the pitch which remains in the vessel. After a certain point of separation has been attained, the exudation of oil from the pitch proceeds very slowly, and, moreover, the last oily extract appears to be of a heavier character; hence it is desirable to draw off the liquid after the stage of rapid separation has terminated and then again after the slow stage has ended. The pitch is now removed to a press to express as much free oil and water remaining in mechanical suspension as may be desired. If the compound of tar, water and oil is taken directly after mixing and before separation has begun, it may be thoroughly mixed with an earthy matter consisting of 1 ton of dried powdered clay and 4 cwt. of dry powdered lime, to for man asphalt corresponding approximately to the natural asphalt used for paving and other purposes. The solid residuum may also be pressed into blocks and used as fuel, for gas making or for firing and other purposes. As these solid compounds contain all the benzene and naphtha of the tar, if desired, a proportion of the volatile matters may be driven off by heat in the usual manner. The red liquor may be treated in stills in the usual way to obtain the various constituents.

Charcoal and Products.

It is proposed by T. Hill Jones to conduct the carbonizing process, to save cost of carriage of the wood, at, or in proximity to, the site of growth of the timber. The wood to be carbonized is stacked in heaps or mounts, covered with turf, and generally plastered over externally with a mixture of earth and charcoal dust. The heap is surrounded with a metal casing, which, for the convenience or portability for transmission from place to place, is constructed in separate pieces, so that it may be readily put together on the spot. Openings are formed in the turf cover for the escape of the vapors into the interstitial space formed by the metal casing. The latter is provided with an outlet for conducting the vapors given off during carbonization to a still head and thence to suitable condensing vessels. The stacks of wood may also be carbonized within a casing of brickwork. Inspection tubes may also be inserted to ascertain the progress of carbonization. By the above mode of procedure the utilization of the products given off during the process of carbonization is said to be secured without impairing the quality of the residual charcoal, the fuel value of which is materially depreciated when the carbonization is carried on in retorts.

The Importance of Guarding the Coast of the United States.

An interesting estimate has recently been made of the wealth and population along the coast of the United States which it would be necessary to defend in the event of war. The Atlantic coast line, exclusive of the Gulf of Mexico, has alone the length of 2,732 miles. The entire coast line of the country, including the Pacific coast, the Gulf of Mexico and Alaska, is 10,376 miles. If, however, the bays and rivers be added, the total will be 90,929 miles. Much of this would not attract an enemy's fleet, and taking simply the outer seaboard, exclusive of Alaska, and not considering the bays and rivers, we have an actual coast of 5,558 miles to be defended. The value of destructible property within the reach of an enemy's guns will be found to be enormous. It has been estimated that in Portland, Boston, New York, Jersey City, Philadelphia, Baltimore, New Orleans and San Francisco, such property would aggregate about $3,836,000,000. It must be considered, however, that these ports comprise only a part of those which require defense. A list of seaport towns made several years ago showed that about 7,000,000 inhabitants were included in the principal seaport cities. The estimated population of all seaport as well as lake towns is over 16,000,000. Another important consideration is that the United States has a commerce amounting to nearly $1,500,000,000.

A NEW marking ink pencil has the solid color at one end in the usual manner and at the other end a receptacle for a liquid mordant.

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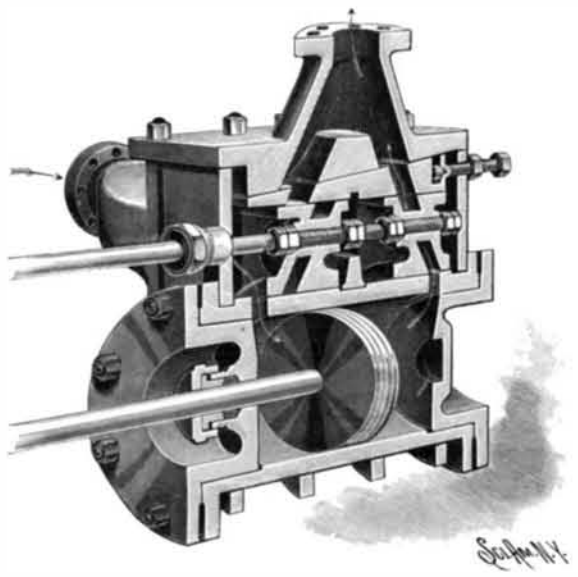
AN IMPROVED SLIDE VALVE.

According to the improvement represented by the illustration, the steam chest is connected at its ends with the cylinder ports, and the slide valve operating in the chest has exhaust ports registering with the cylinder ports and with ports in an adjustable plate connected with the exhaust chest. The invention has been patented by Mr. Albert B. Van Wegen, of Coudersport, Pa. The adjustable plate, in which are ports registering with the exhaust ports, engages the tops of the valves and is fitted to the underside of the exhaust chest. It is wedge-shaped and is adjustable by means of a screw, to take up wear, so that a steamtight joint



VAN WEGEN'S BALANCED VALVE.

is at all times formed between the valves, the plate, and the exhaust chest. The valves are connected with each other by a valve stem, nuts screwing on the threaded inner end of the stem for properly adjusting the valves relative to the ports. The bearing surface of the valves is preferably shaped according to the exterior surface of the cylinder, on which a circular valve face is thus formed. The several parts are fastened in position by means of clips passing around the cylinder and whose ends pass through and are tightened up by nuts on flanges on the outer edges of the exhaust chest. With this valve arrangement full provision is made for delivering the live steam directly through straight ports, and the valve freely moves within the steam chest without requiring much pushing or pulling power.

A MACHINE TO HARVEST STANDING CORN.

As this machine is drawn between two rows of standing corn, the stalks severed by the knives are received by the farmer or his helper as they naturally fall back on the platform of the machine, the stalks being laid with their butts rearward on a dumping platform or cradle, where they may, when a sufficient quantity has accumulated, be conveniently tied in the form of a

AN IMPROVED CORN HARVESTER.

shock, and deposited upon the ground in an upright position. The improvement has been patented by Messrs. Charles A. and Harold A. Low and Albert M. Messenger, of Lake View, Iowa. The cutting knives are secured upon beveled side portions at the front of the platform, there being guards at the rear outer edges of the knives, and at the rear of the platform on each side is a railing formed of two uprights and an upper cross bar. Between these railings, and fulcrumed upon the rear uprights, is a dumping platform or cradle, which normally lies horizontally upon the platform, but it may be raised or lowered by a forwardly extending handle. A flexible shaping strap, preferably formed of spring metal in a substantially U shape, is centrally attached to the dumping cradle, and pivoted to the rear uprights is a guide yoke whose shanks extend downward to the cradle, their lower ends having friction rollers adapted to engage the under faces of the side bars of the cradle. A retaining chain connects the shanks of the yoke with the main platform of the vehicle, limiting the downward movement of the yoke as the shock is being dumped. There is on one of the uprights a twine box and on the opposite upright is a catch to receive and hold the free end of the wire or cord, which may thus be conveniently arranged for the binding previous to commencing the formation of a shock. By means of the shaping strap the stalks are first drawn closely together before tying, after which, upon lifting the cradle, they are tipped over upon the ground. As the machine is drawn forward after dumping the shock, the cradle is restored to a horizontal position, the guide yoke being simultaneously slipped from over the shock, and, by the engagement of the rollers upon its shanks with the cradle, the yoke is carried to its normal angle, tipping slightly to the rear from the vertical.

New Agricultural Machines Called For.

Secretary of Agriculture Morton declares that the plow used by the American farmer is an enemy to fertility, and that the invention of some means of stirring up the soil and subsoil is very badly needed. He believes that the common plow, when used in stoneless soils, packs every furrow it passes over and renders it impervious to rain. The secretary explains this fact as follows:

"The draught of the plow is downward to such an extent that the full force of the team's strength is exhausted in pressing the bottom of the furrow into a polished trough for the conduction of rain down the side hills. It is necessary to stir up the soil and subsoil for eighteen inches. If, for instance, it were possible to loosen the soil and subsoil down for three feet all over the State of Nebraska, we could then, with an annual rainfall of twenty inches, make abundant and profitable crops. Until deep plowing—through subsoil tillage—becomes universal in that commonwealth, there will be, year in and year out, no certainty of remunerative crops.

"Prof. Shaler, of Harvard, estimates that the present inefficient and ill resulting methods of plowing, especially upon undulating lands, cost the agriculturists of the United States 250 square miles of soil each year by erosion. Everywhere in Nebraska, where torrential rainfalls are so frequent, the side hills verify Prof. Shaler's theory as to the annual waste of washed lands.

"This is a matter of such vast importance," continued the secretary, "that I have asked Chancellor Canfield, of the University of Nebraska, to bring it before the sixteen hundred students in that institution and ask them to try and think out a new implement of agriculture which shall supersede the plow. It is a subject upon which the inventive minds of educated farmers should be concentrated. A proper solution of the difficulty will facilitate subsoil tillage and at the same time save both the crops and the soil.

"In my judgment the coming implement should spade the land and turn it over, as a man who pushes the spade with his foot into the ground, and, drawing the spade out, turns the soil upside down by the twist of his wrists. Possibly a rotary spader could be invented. Possibly an implement consisting of a large number of revolving knives could be made so that in passing over the surface of the field it should chop up the soil and subsoil for two feet in such a manner as to render the percolation of the rainfall, down to the depth at which the ground has been stirred, very easy and perfect."

[We think if the records of the Patent Office are examined, various devices for subsoil stirring, also spading and digging machines, will be found.—Editor SCIENTIFIC AMERICAN.]

Soap and Washing Compounds.

Two molecules of sodium sulphate and one molecule of sodium bicarbonate are dissolved in water. The solution is boiled and allowed to crystallize, when a new body, termed "a basic carbonated sulphate of soda," is formed, the crystals of which salt possess the following composition:

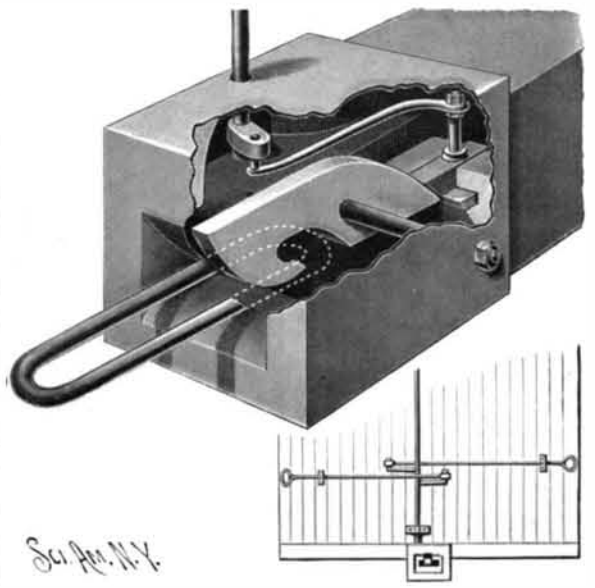
Sulphuric anhydride	21·27
Carbonic acid	5·15
Soda	31·50
Water of crystallization	42·08
	100·00

It is feebly alkaline, and is said to possess great detergent power.

In using this product for the manufacture of soap, six parts of fatty acids are heated to 120 degrees to 130 degrees C.; then five parts of the "basic carbonated sulphate of soda" (melted in its water of crystallization) are gradually added, and the whole boiled until the fatty acid is saponified. A washing powder may also be prepared by grinding together the sodium sulphate and bicarbonate in the dry state. It is said to be less hurtful to the skin and fabrics than ordinary soap is.

AN AUTOMATIC CAR COUPLING.

The illustration represents a simple form of coupling in which the old style of link is used, the coupling together of the cars being effected automatically, while the cars may be uncoupled from either side or from the car roof. For this improvement a patent has been granted Mr. Henry C. Morton, of Mint Hill, Mo. In a chamber of the drawhead is pivoted a latching hook having a downwardly curved hook nose, while the rear end of the hook has its top edge convex curved. Opposite and adapted to bear upon the rear end of the hook body is arranged a slide block having a vertical



MORTON'S CAR COUPLING.

post connected by a horizontal curved bar with an arm on the lower portion of a vertical shaft, the latter being extended up to the roof of the car, where it is provided with a hand wheel. On the vertical shaft are also two crank arms, just above the drawhead, as shown in the small view, a pull bar extending from each crank arm to one side of the car. When two cars are to be coupled, the link is introduced in one of the drawheads and held in horizontal position by the latching hook as indicated by the dotted lines, the coming together of two cars then causing the hook of the approaching coupling to slide upon and over the end of the coupling link, and drop by gravity to the locked position. When the cars are to be uncoupled, the train man, by means of the hand wheel or one of the pull bars, rotates the shaft to move forward the slide block, thus depressing the rear end of the hook and raising its front end, whereby the link is released.

A CONVENIENTLY ADJUSTABLE CHAIR.

The chair shown in the picture has a flexible back and seat, and is readily adjustable to permit one to sit or lie at any desired inclination. It has been patented by Mr. Hermann Evers, of Mazatlan, Mexico. The illustration represents the chair folded up, in extended position for lying down, and in a more upright position, with its foot and leg extension arranged to form

EVERS' FOLDING CHAIR.

a footstool, although, as will be readily seen, these are only a few of the various adjustments provided for. Its rectangular pivoted frames, supporting the seat webbing, are held in desired adjustment by the engagement of a cross bar connecting the pivoted legs with notches in the lower side bars, after the usual style of steamer chairs, and to the front ends of the side bars is hinged a foot and leg rest. The hinge connection consists of links and a cross bar, forming a double hinge, and the front end of the leg rest is supported by a frame adjustable to any desired position for sitting or reclining, or permitting the extension to be folded back underneath and fastened to the chair frame, when the chair may be used as one without an extension.

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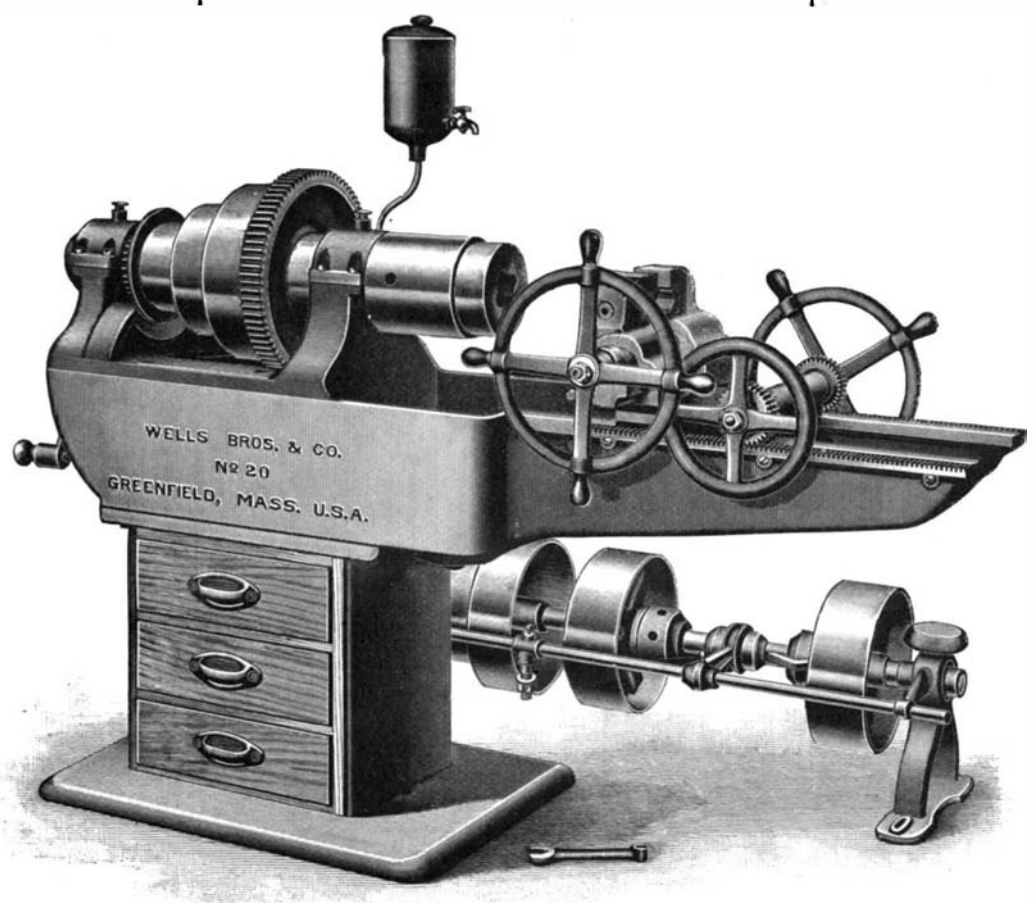
A NEW BOLT CUTTER AND NUT TAPPER.

The machine shown in the illustration has been especially designed to screw-thread the larger sizes of bolts and nuts, and is consequently made very strong and stiff, being also adapted to cut all sizes from a quarter of an inch to two inches in diameter. It has been recently placed on the market by Messrs. Wells Bros. & Co., of Greenfield, Mass. It has three step-cone pulleys, is back geared, and is furnished with friction clutch countershaft, increasing its capacity to turn out work rapidly. The drawers in the base of the machine afford convenient receptacles for tools not in use.



A LARGE-SIZE BOLT CUTTER AND NUT TAPPER.

THE COMING ATLANTA EXPOSITION.

The New South was not satisfied with the inadequate display made of its industries at the Chicago Exposition of 1893; so that before the World's Fair closed it was virtually decided to hold a special Cotton States Exhibition at some city in the South. The project was warmly favored by the Southern press. Atlanta, Georgia, was selected as the site for the exhibition, and the result of the unabated zeal of the promoters is the Cotton States and International Exposition, which will be held during the winter of 1895-96. It will be opened September 15. An expenditure of over $2,000,000 has been provided for, and the scope of the enterprise has been enlarged to include exhibits from all States in the Union and foreign countries. Atlanta is one of the most progressive cities of the New South, is a great railway center, and has a population of 65,533, according to the census of 1890. The president of the exposition is Mr. Charles A. Collier.

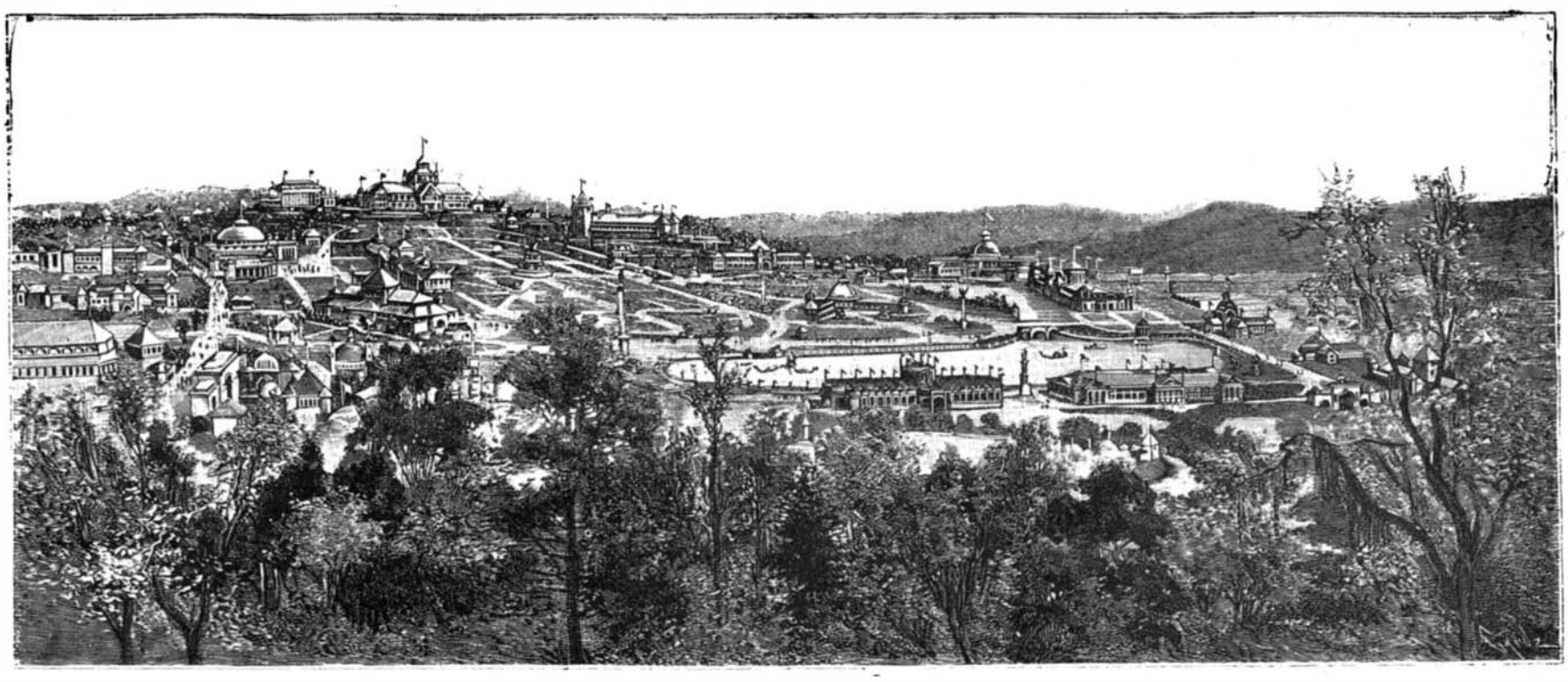
The exposition will be held at Piedmont Park, a site which possesses remarkable advantages. The park is situated about two miles from the heart of the city, and is approached by the Southern Railway and handsome drives. Piedmont Park includes about 189 acres, and $550,000 will be spent in heightening the natural advantages by skillful landscape gardening and the creation of artificial lakes. Gondolas and launches will be a feature of the exposition. It is not intended to have the new exposition attempt to rival the Columbian Exposition either in architecture or industrial pretensions; but it will be a complete exhibit of the resources and industries of the New South. The old race track has been converted into a garden of Southern flowers, with an electric fountain in the center. This garden will be in plain view from all the buildings and from the high knolls on the borders of the park, and with the great lake behind it will make a beautiful setting for the architecture of the Fair. To the north of this central garden will stand the Government building, which is located between the Fine Arts building and a group of foreign and State buildings. The grouping is so artistic that no structure will be behind another. To the east of the Government building and with the long side fronting on the garden is the Manufactures building. Between the garden and the lake there is ample space for the Woman's building and the Horticultural building. On the further border of the lake, which will occupy over 20 acres, will be grouped the Electricity, Mining, Transportation, Music, Machinery, Minerals and Forestry buildings. In the extreme southern ground, occupying a commanding position, are the Negro and Tobacco buildings. The circuit of the grounds will be completed by the Agricultural building, the Auditorium and the Theater. Other minor buildings will also be erected.

Cheap imitations of the Columbian Exposition's buildings have been avoided, and as much attention has been paid to the interior as to the exterior. The government promises to have one of the finest buildings on the grounds; the appropriation was $200,000. The negro exhibit will be particularly interesting, and will illustrate the progress made by the race since their emancipation. The "Midway Plaisance" will be the Terraces, and only genuine attractions will be permitted.

The Silk Industry in Syria.

The production of silk in Syria has, says the Journal de la Chambre de Commerce de Constantinople, considerably increased of recent years. The towns and villages in which the greatest attention is devoted to the sericulture are the following: Baalbek, Serin, Ras, Machghara, Sahbine, Chtora, Hasbaya, Ain-el-Hraiche, Ain-Ata, Brit Lahie, Nabeh, Malonia, Giroud, Maara, Sidnaja, Essal-el-Ward, Douma, Khyara, Chafounie, Jaramana, Chabaa, Catana, El Hame, and Tsaxa. In 1893 about 900 pounds weight of silkworms' eggs were used in these towns and villages. The eggs used in Syria are of Corsican origin; the greater part come from France and a small quantity from Italy. As regards the Japanese varieties, these have entirely ceased to be imported. It is the merchants of Beyrout and the Lebanon who engage in the business of importing silkworms' eggs, and who sell them to the Syrian breeders. These merchants exercise the greatest care in all their operations, and some even go so far as to travel themselves to France to make their purchases.

All the eggs imported are subjected to a most rigorous examination, and in some cases they are examined by means of microscopical instruments. They arrive in boxes of about twenty-five grammes weight, and are sold at prices varying from three to six francs, according to quality and guaranty. The payments are made at once, or at the end of the harvest, in kind—that is to say in cocoons. In the latter case the amount due to the seller varies according to the district. For example, at Rachaya, in the villages of Ouadi-el-Adjam and Douma, one-seventh of the silk harvest is given; at Baalbek and Hasbaya a little more, and in the villages of Bekaa, one-twelfth. This difference is accounted for by the fact that the yield of eggs is by no means the same in all localities in which the silk industry is engaged in, on account of the greater or smaller amount of care and attention bestowed by the breeders—for the climate is favorable throughout the country. Attempts have frequently been made at the production of native eggs, but they have invariably been unsuccessful. This is generally attributed to the following causes: That the choice of the worms is made without due care and attention; that the eggs are not examined microscopically; the color and dimensions of the cocoons are mixed, and the eggs are not preserved until the moment of incubation, in favorable places. In Syria the weaving of silk is as old as the cultivation of the raw material itself. The silk weavers of the present day work principally for domestic production. The native manufacturers have had much to contend with from foreign competition, which made itself severely felt, and markets that were formerly controlled by Syrians are now disputed by European manufacturers, who, with their skilled artisans and with the aid of improved machinery, find competition with the older methods comparatively easy. The greatest specialty in the native silk stuffs, and in which Syria undoubtedly excels, is that in which cotton forms the warp, and in which the greater or lesser quantity of silk in the weft determines the quality. The principal silk manufactures are the Kaffiehs, or headdresses, Aboyas, or Syrian cloaks, shawls, tobacco pouches, slippers, pillowcases, stuffs for dress goods and stuffs for upholstery.



BIRD'S EYE VIEW OF THE COTTON STATES AND INTERNATIONAL EXPOSITION AT ATLANTA, GA., TO BE OPENED SEPT. 15 1895.

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Books of the Ancient Mexicans.

At the 289th corporate meeting of the Boston Scientific Society, the principal paper was entitled The Cortes Codex, the speaker being Dr. J. Walter Fewkes. When Cortes landed in Mexico, he found a people who were about equal in civilization to the ancient Etruscans. It is true that they did not have the art of working iron, but they were a literary people and actually had books. A system of writing seems to have been common to all the peoples of Mexico and Central America, and in Yucatan, it appears, a much greater advance in the art had been made than in the other States. When the lieutenants of Cortes landed in Yucatan, the priests, imbued with the strong religious feeling of the age, declared these books to be instruments of the devil, and they were publicly burnt, very many of them being destroyed. But in some way four of them found their way to Europe, where they were placed in libraries, and it is now permitted to scholars to study them. These books are what are known as codices, and of them Dr. Fewkes spoke quite in detail.

The first and best of the codices is in Dresden. It is a book about ten inches in length and three or four in width; the material of which the paper is made is the agava pulp, and upon this characters are painted. The books open after the fashion of the Japanese screen, and both sides are used for the letters. The Dresden Codex has been closely studied by Dr. Foerstemann, who has published a volume on the subject. The second of the Maya books is in the Bibliotheque National, in Paris, but it is small and poor. The two others are in Madrid and are known as the Codex Cortesianus and Codex Troyanus. Of the former, Dr. Fewkes spoke in particular, both fragments being considered, however, to have been originally parts of the same book. With the enlightened spirit of the age, the Spanish government published in 1892 a facsimile of the Cortes Codex, in commemoration of the discovery of America by Columbus. One of these facsimiles is in the possession of Dr. Fewkes, being a book of forty-two pages.

The characters which are to be found in the Codex are the same as those covering many ruins in Central America, figured on pottery and scratched on bone and shell, and if the books can be deciphered, there will be furnished the key to these old writings which have not yet been read. The characters may be broadly divided into three groups: numerical signs, *pictorial elements* and hieroglyphics; the latter group being divisible into day signs and hieroglyphs pure and simple. The most acute scholar in the numerical part is Dr. Foerstemann, who has shown that the people who made these books knew numbers, and very high numbers at that. Dr. Foerstemann deciphered the zero and the numerals which run into the millions, the higher ones of which have some relations to the planetary times of revolution.

The investigator who has done most to determine the exact character of the hieroglyphs was Brasseur de Bourbogne, who found the Cortesian Codex the symbols for the days, and concludes that it has significance in an astronomical or astrological sense.

The work of Dr. Fewkes in the matter has been in the consideration of the pictorial elements of the Cortes Codex. He has first assumed that the pictures are related to the other characters. In examining the pictures of the Codex, he has found that there are one hundred and twelve altogether—animals, men, and humans with monstrous heads or masks. What do the latter mean? Through his knowledge of the habits of the Moqui Indians, he was aware of the place of the personification of the different gods in the ceremonies, this being done by a man with a symbolical mask. Accordingly he had studied the different masks in the Codex and had been able to find among them the symbols which belong to certain of the gods—the god of war, a skeleton, the long-nosed god, the snake god, the corn goddess, and the like. In an interesting manner, aided by enlarged drawings of the Codex figures, he showed the reasons for connecting a certain picture with a certain god. All the figures, the animals excepted, can be thus referred to some of the gods, and they seem to have relation to the astronomical signs, although that matter has not yet been cleared up.

Dr. Fewkes was particularly interesting in the description of his investigations, referring incidentally to the customs of the modern Indians, relating an occasional legend and describing the secret ceremonies of the secret societies of the Moqui Indians, being himself a member of these societies and having witnessed their ceremonials. His paper was made the more interesting by the exhibition of facsimiles of the different Codices, works of great rarity and value, which he has acquired in his study of these antique bits of writing.—Boston Commonwealth.

Cleaning Clothing.

Mullerson's preparation is a mixture of turpentine, 26½ parts; ammonia solution, 19 parts; methylated spirit, 25 parts; ether, 2¼ parts; acetic ether, 2¼ parts; and water, 25 parts; all by weight.

Gold Production in South Africa.

The extraordinary growth of the gold mining industry in South Africa, and the consequent rush to invest money in a country which was hardly known five years ago, but which now takes rank second among the gold producers of the world, make a brief analysis of the reports available from the Witwatersrand District in the Transvaal, from which nine-tenths of the South African production is at present drawn, a matter of much interest. The material for this analysis is found in the reports issued each month by the Johannesberg Chamber of Mines, which give in detail the output of the district.

The rapid growth of mining is shown at a glance by a statement of the gold production for four years past, which was: 1891, 729,238 ounces; 1892, 1,210,868 ounces; 1893, 1,478,477 ounces; 1894, 2,035,970 ounces. The output for last year was thus very nearly three times that of 1891. A comparison of the years 1893 and 1894 may enable us to draw some conclusions as to the district and its future.

An important point in the returns for last year is the gradual and apparently steady decrease in the average returns per ton obtained. The total amount of ore worked last year in the mills was 2,827,365 tons, and the average obtained per ton by milling work was 0·46 ounce (0·37 fine ounce = $7.65) per ton. This was a decrease of 3·4 per cent from the average reported in 1893. If we take the complete returns, including all gold obtained from concentrates and tailings as well as from milling, we find the average return on the ore mined in 1894 was 0·72 ounce (0·576 fine ounce = $11 91) per ton, against 0·67 ounce (0·536 fine ounce = $11.08) per ton in 1893. That this increase was only apparent, however, is shown by the fact that the quantity of tailings worked over last year was 2,674,673 tons, while in 1893 it was only 1,217,792 tons: that is, the output of 1894 included a considerable amount from accumulated tailings of previous years' workings. A fairer way of comparing the averages is to take each source of production separately, as we have done in the following table:

	1893.	1894.	Changes.	Per cent.
Ore milled	2,203,704 tons.	2,827,365 tons.	I. 623,661 tons.	28·3
Tailings reworked	1,217,792 "	2,674,673 "	I. 1,456 881 "	119·6
Yield per ton, ore	0·479 oz.	0·462 oz.	D. 0·017 oz.	3·4
" " " tailings	0·250 "	0·229 "	D. 0·030 "	13·6
Total yield:				
Milling ore	1,056,383 oz.	1,305,408 oz.	I. 249,025 oz.	23·6
Tailings	304,498 "	587,388 "	I. 282,890 "	92·9
Concentrates	62,737 "	84,579 "	I. 21,842 "	34·8
Other sources	54,859 "	58,595 "	I. 3,736 "	6·8
Total	1,478,477 oz.	2,035,970 oz.	I. 557,493 oz.	37·7
Fine ounces	1,182,782 "	1,628,776 "	I. 445,994 "	37·7
Value	$24,448,096	$33,666,900	I. $9,218,804	37·7

In giving the fine ounces and the value throughout we have taken Witwatersrand gold as 0·800 fine, this conclusion being derived from the statements of its value uniformly given. It is much to be regretted that for this—and indeed for every—district the returns are not made in fine ounces.

Several points are brought out more clearly by this table. Fully as large and perhaps a larger part of the gold was saved in milling last year; for while the proportion of mill gold was 64·1 per cent of the total in 1894 and 71·5 per cent in 1893, the difference is more than accounted for by the large increase in quantity of tailings. The amount obtained from concentrates, chiefly by chlorination, shows some increase in the pyritic contents of the veins as the workings increase in depth, but not in any large proportion. Taking the ore and tailings together, we find that there was an increase of 60·8 per cent in the tonnage handled to obtain an increase of 37·7 per cent in the gold output; but these proportions will hardly hold good in the present year, when the proportion of tailings worked to ore milled will probably be much less than it was last year.

The important data as to the cost of working on the Witwatersrand are lacking. The amount paid in dividends has been large, but there are many companies which have paid nothing to their shareholders. The cost of supplies and fuel is gradually decreasing, owing to the improvements in transportation and the development of the coal resources of the Transvaal; but these savings may be offset by the increasing demand for labor, and the difficulty of obtaining it. So far we have nothing on which any close estimate of the average cost of mining in the district can be based, and only the fact that many companies are paying dividends on returns of $10 or $12 per ton seems to show that these low grade ores can be handled at a profit. More detailed information as to costs would be of the greatest interest to the mining world.

As to the future production of the Witwatersrand no predictions can safely be made. The old accumulations of tailings are nearly exhausted, so that the addition to the output from this source will be somewhat less hereafter. The confidence of the large companies in the future is shown by the fact that they are adding to their mill capacity and the 2,400 stamps now at work will be increased by nearly one-half within the next six months. While the ore shows a tendency to decrease slightly in value with depth, there are no indications of its exhaustion. Moreover, there is a considerable area, through which the great banket vein is believed to extend, which has been hardly touched as yet. On the other hand the general belief in the richness of the vein at great depths rests thus far on the indications of a few borings, and none of the "deep level" companies which are now sinking exploration shafts will be in a position to report results for a year to come.

It is fairly safe, however, to expect a large production from the Witwatersrand for at least several years to come; and when the mines of that district begin to shown signs of inevitable exhaustion, the new fields of Matabeleland and Mashonaland will probably be producers, so that South Africa will continue to be a very important factor in the gold supply of the world.—Engineering and Mining Journal.

Dishonesty the Nation's Peril.

Anybody who has been but a casual observer of events in this country must have been forcibly impressed with the recent growing tendency to dishonesty and downright villainy in politics, official life, corporate responsibility and private business obligations. There may be as many honest men in all these relations to-day as at any period of the country's history, but it looks as if there were certainly an augmenting number of rank rascals.

This is seen first in the almost entire lack of honesty, honor and patriotism among politicians, the men who run the political machinery, from the township organizations to State and national conventions. Politics has become a word to which nobody but an ignoramus or a sophisticated office seeker attributes any element but that of dishonesty and fraud. It means a scheme of designing men to get the offices and thereby the chances to deceive and rob the people. In the older days of the republic men who sought office claimed and were accorded some degree of honor and sense of responsibility to their constituencies. They were to a large degree, at least, actuated by a patriotic desire to acquit themselves so as to be considered patriotic citizens, with a good name to preserve and hand down to posterity. Probably that feeling and motive is somewhat rife in the rural communities at the present time; but in the larger cities, if any of it remains, it is neither conspicuous nor emphatic. Men now seek office "for what there is in it" to them, and with small regard to the good of their constituents. They connive and combine to get the support of the worst elements in the community, because those elements represent the greatest number of votes. They cajole and fool the ignorant, the debased, and the victims of demagogy for the sake of votes, and the selfish partisans among the so-called better classes fall into line so as to be on the winning side. Officials thus elected cannot be expected to administer public affairs with much reference to anything but their own selfish interests. It cannot be expected that they will be much better than their constituencies. The effect of this debased motive in politics is to prostitute legislation to partisan ends, which are usually those of compromise with cliques which conspire to rob the people and fatten the conspirators. It also enables a lot of mediocre or low grade, unprincipled men to get into office, and thus the body politic is permeated with dishonesty and, what is almost as bad, brainless, conscienceless incompetency.—N. W. Lumberman.

The Late Crown Prince of Siam.

In accordance with Siamese custom the body of the late prince, after being very tightly bound up, with the knees brought up under the chin, was introduced into an iron urn, which again was put into a magnificent urn of gold, studded with precious stones. This has been placed on a golden, four-sided, truncated pyramid, about 9 feet high and 12 feet square at the base, in a small room in a building adjoining the grand palace, and known as the Phratenang Dhusidth Neahaprasadh. The room is suitably adorned with mourning emblems; one wall contains the late prince's orders, etc., in glass frames. A large body of Buddhist priests chant appropriately in an adjoining room night and day, and several of the king's brothers are in constant attendance round the catafalque. And there the body will remain, probably for a whole year, to be then consigned to the flames with extraordinary pomp on an enormous funeral pile.

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THE NAPHTHA LAUNCH OF THE GAS ENGINE AND POWER COMPANY OF NEW YORK CITY.

No type of a power-propelled boat has acquired such popularity in so short a space of time as has the naphtha launch. The proprietors of the establishment where these boats are manufactured, the Gas Engine and Power Company, of Morris Heights, 185th Street, New York City, term it "the only naphtha launch," and with very good reason, as hitherto it has been without real competitor. While these boats are used extensively in all waters, and have become a most familiar object to all, it is fair to say that very few people know how they are operated.

The engine by which they are driven is a three cylinder, single acting engine specially constructed for naphtha, although it will work perfectly well with steam or compressed air. The engine is surmounted by a double asbestos-lined jacket resembling in contour a boiler. Within the jacket is a coil of pipe, immediately below which is a burner for naphtha gas or vapor.

Referring to our illustration of a section of the naphtha launch, a tank for holding the naphtha will be seen in its extreme bow. From the tank a pipe connects with a small pump at the base of the engine, by which naphtha is pumped into the coil of pipe. Into the top of the coil boiler, for such it is, a pipe is tapped that supplies naphtha to the burner. In operation the coil is first made hot. This is done by hand-pumping naphtha vapor mixed with air into the burner, where it is lighted. When the coil is hot, naphtha is pumped into it. This is at once vaporized and develops pressure. The pressure is turned on the engine, which in a few minutes starts to rotate. An injector cock supplies the burner with naphtha, drawing air in also, and the engine thereafter takes care of itself.

At each stroke naphtha is pumped into the coil by the engine. This develops in ordinary practice a pressure of sixty-five pounds in the heated coil. From the top of the coil the naphtha vapor, before it reaches the burner, is drawn off and mixed with air after the fashion of the Bunsen burner. It burns below the coil with a clear blue flame. Near the injector is a damper by which the supply of air is regulated so as to produce this character of flame. After the naphtha vapor has acted upon the pistons and goes off through the exhaust it is condensed. A regular outboard condenser is employed, the pipes running along outside the garboard of the boat. The naphtha thus condensed is forced back into the tank to be used over and over again. The delivery of naphtha from the tank can be cut off by a special valve, shown in a section of the boat, which valve, however, in practice never need be closed.

One of our illustrations gives a perspective view of the engine, while another one shows it in section, giving a complete detail view of the construction. The view in elevation shows the general disposition of parts. At A is seen one of the sight holes, by which the character of the flame can be watched so as to be regulated. Through this hole, too, the burner is lighted, and further up in the casing is a second sight hole, through which, also, the flame can be watched. At C is the injector valve, and immediately below can be seen the flaring mouth with damper, I, by which the air supply to the burner is regulated. D is the naphtha valve through which the naphtha is admitted. B and E are respectively air valve and air pump, which are used only for starting the engine. F is the naphtha pump used for the same purpose. This pump goes out of use once the engine is started, a separate one worked by the engine itself doing the work. The hand wheel, G, starts and reverses the engine according to which way it is turned.

Our view of the section of the engine may be studied more intelligently after inspection of the elevation. The cut shows its three cylinders with the piston rods bearing against hard steel cups beneath the pistons. Each piston is surmounted by its own slide valve, which slide valves are operated by a triple crank shaft. The burner and naphtha coils and the construction of the injector valve, nozzle and air damper are also made clear. Leading out to the right is seen the shaft, whose thrust is taken by a ball bearing, which is seen in section immediately forward of the after sleeve coupling.

In starting it air is pumped into the naphtha tank, escaping therefrom highly carbureted, so as to provide what is practically a gas for starting the fire. The whistle is blown by a hand pump, or in some of the boats an air tank is established forward, which is kept charged with compressed air by the engine, and the whistle is blown by this air. In our sectional view of the boat the air tank is shown immediately aft of the naphtha tank.

The working parts of the engine are completely incased, so that all leakage of naphtha goes direct to the exhaust chamber. Another point of safety is that the fire is taken direct from the boiler, so that if the feed pump should fail to work, shutting off the naphtha supply to the boiler, the fire would at once go out, and the engine would stop.

These little boats have won for themselves an astonishing record. They seem to be as absolutely secure from accident as any kind of power-driven craft can be. Every possible precaution is adopted in their construction to render accident impossible. The boiler is made sometimes of seamless copper tubing, sometimes of heavy iron tubing, with sleeve or threaded joints brazed throughout. The entire engine compartment is bulkheaded off and lined with sheet brass, so that if naphtha burns there it does no harm. The naphtha tank compartment is also bulkheaded off and communicates by sea pipes with the water, so that water is continually going in and out, washing away any trace of naphtha. The entire midship section or waist is unobstructed, and under normal conditions whatever slight amount of heat there may be from the engine is carried aft, away from the passengers. The company's tests have been most exhaustive, but nothing proves the safety of the boats so much as the record which they have made since the foundation of the company. Our other views show the interior of the boat building shop, where will be recognized the familiar form of the hull of the naphtha launch.

Growth of the Phosphate Industry in the South.

It is not generally known that the United States is fast becoming the principal phosphate producing country in the world. The interest is one of the first importance from both the commercial and economic standpoints, and it is remarkable that it has been developed to its present proportions since the civil war. Phosphate beds were discovered in South Carolina as far back as 1837, but they were not worked to any extent until 1868, when their output amounted to some 11,862 tons. Rich deposits of phosphate were found in Florida in 1881. The growth of the industry in these two States during the past few years has been very remarkable. In South Carolina last year some 30 phosphate mines produced 294,000 tons of phosphate and in Florida 106 mines yielded during the year 500,000 tons. The total output of the entire country for the year was 1,550,000 tons, and this exceeded the output of Germany, which was the largest European phosphate producing country, by 50,000 tons.

The importance of the phosphate beds in enriching a vast area of farm land, and thus developing the agricultural interests of the United States, can hardly be overestimated The production of our enormous cereal crops results in a constant exhaustion of the soil. It is estimated that a single crop of cereals in the United States takes from the soil upward of 17,650,270,800 pounds of mineral matter and over 2,000,000,000 pounds of ash and phosphoric acid. An acre of land must supply about 19 pounds of phosphoric acid to produce one cereal crop. The need of returning to the soil some of the phosphoric matter which is constantly being drawn from it in time becomes a necessity. The numbers of abandoned farms in New England bear witness to this fact. In the South, and especially in the vicinity of the phosphate beds, the phosphate has been used in immense quantities. Georgia consumed the largest quantity, or 280,000 tons, and South Carolina 200,000 tons. The New England States used in all 60,000 tons; New York 90,000 tons; Pennsylvania 150,000 tons; and Delaware 20,000 tons. It is significant that very little phosphate was used in the West, where the soil is still virgin. The phosphate deposits cover a large territory in North and South Carolina and in Florida, and it is believed that the supply cannot be exhausted for many years.

Storage Battery Traction in Paris.

Regarding electric storage battery traction on the lines of the Tramways Nord, at Paris, the Revue Industrielle says that the cost per car kilometer has been found to be 0·53 fr., as compared with 0·56 fr. for animal traction. This, however, does not take into account the cost of battery repairs, which would increase the figure for electric traction quite considerably. The storage battery cars used by the company will seat 52 passengers, and, within the city, run at a maximum speed of 7½ miles an hour. Outside of the city limits the speed can be increased to about 10 miles an hour, and even on the heaviest grades does not fall below about 4 miles an hour. Each car is equipped with a battery of 108 cells, divided up into 12 boxes of 9 cells each. These are united into 4 groups, each capable of supplying a 50-volt current. Two motors are on each car.

Drops.

Dr. Eder, in the following table, gives the number of drops required to make a cubic centimeter, showing the variations in the size of drops of different liquids:

Water	20
Hydrochloric acid	20
Nitric acid	27
Sulphuric acid	28
Acetic acid	38
Castor oil	44
Olive oil	47
Oil of turpentine	55
Alcohol	62
Ether	83

Correspondence.

Commencement of the Manufacture of American Plate Glass.

To the Editor of the SCIENTIFIC AMERICAN:

Mr. Ford built his first works at New Albany, Ind., in the year 1869. This was the first attempt to manufacture polished plate glass in the United States, although rolled plate glass had been made for a number of years prior to that time. In the year 1882, Mr. Ford came to Pittsburg and formed the New York Glass Company and established a plate glass works at Creighton, and from this small beginning emanated the Pittsburg Plate Glass Company of to-day, which leads the world in this particular line of industry. The establishment of the plate glass manufacturing industry in the United States has reduced the cost to consumers over 200 per cent. This has been brought about through wresting the monopoly from the European manufacturers who formerly controlled the market, by reason of greatly improved methods of manufacture introduced from time to time from the inventive minds of American workmen, and by the home production of all the raw materials required in the business, which was developed as the growth of the business created the demand, and which greatly cheapened the cost.

In this connection, it is interesting to note the effect home production has upon the cost of materials, which, up to the time of the introduction of their manufacture in this country, were made and controlled by Europe. When Mr. Ford first started his New Albany works, he was obliged to import all his woolen felt for polishing, at a cost of $1.45 per pound; to-day the entire consumption is made in America, at a cost of less than 60 cents per pound, and not only gives employment to a large number of workmen, but affords a large market for American wool as well. Another remarkable instance is soda ash, or carbonate of soda. In 1869, this material was imported from England, and cost in the neighborhood of $60 per ton. To-day Mr. J. B. Ford is making better soda ash than was ever imported from England, at his works in Wyandotte, Michigan, for about $20 per ton.

F. S. BRACKETT.

Creighton, Pa., February 5, 1895.

Artificial Whalebone.

According to Le Genie Civil, the Munck process for the manufacture of artificial whalebone consists in first treating a raw hide with sulphide of sodium and then removing the hair; following this, the hide is immersed for a period of twenty-four to thirty-six hours in a weak solution of double sulphate of potassa and is then stretched upon a frame or table, in order that it may not contract upon drying. The desiccation is allowed to proceed slowly in broad daylight, and the hide is then exposed to a temperature of from fifty to sixty degrees; the influence of the light, combined with the action of the double sulphate of potassa absorbed by ths skin, renders the gelatine insoluble in water and prevents putrefaction, the moisture, moreover, being completely expelled.

Thus prepared the skin is submitted to a strong pressure, which gives to it almost the hardness and elasticity which characterize the genuine whalebone, with the advantage that before or after the process of desiccation any color desired may be imparted to it by means of a dye bath. The material can be rendered still further resistent to moisture by simply coating it with rubber, varnish, lac, or other substance of the kind.

Hotels in East India.

A hotel in India is in some respects quite unlike a hotel anywhere else in the world. Every guest has a servant of his or her own. The hotel has some servants, but the guests do not depend upon them at all. My servant takes care of my room, brings me my tea and toast when I arise, prepares my bath, and waits upon me at table. He also keeps my clothes clean and my boots blacked, sees to my laundry, gets me a carriage when I want one, and does my errands. When traveling he will attend to the tickets and the luggage and make my simple bed on the cars, for India is a country of magnificent distances, involving considerable night travel. There are no regular sleeping cars like ours, but the seats are long enough for the passengers to stretch out on and wide enough to make a reasonable couch, which the traveler provides with his own thin mattress, pillow and wraps. The number of servants in a great hotel is confusing at first. In a long corridor you see one before each door. They usually sleep there, wrapped in a sheet or blanket and curled up on the floor.

RECENTLY a court in New York decided that money dropped upon the floor of a street car, although by falling between the slats of the wooden mat it had become entirely hidden, was a lawful tender of fare, which the conductor must not only accept, but supply the required change.

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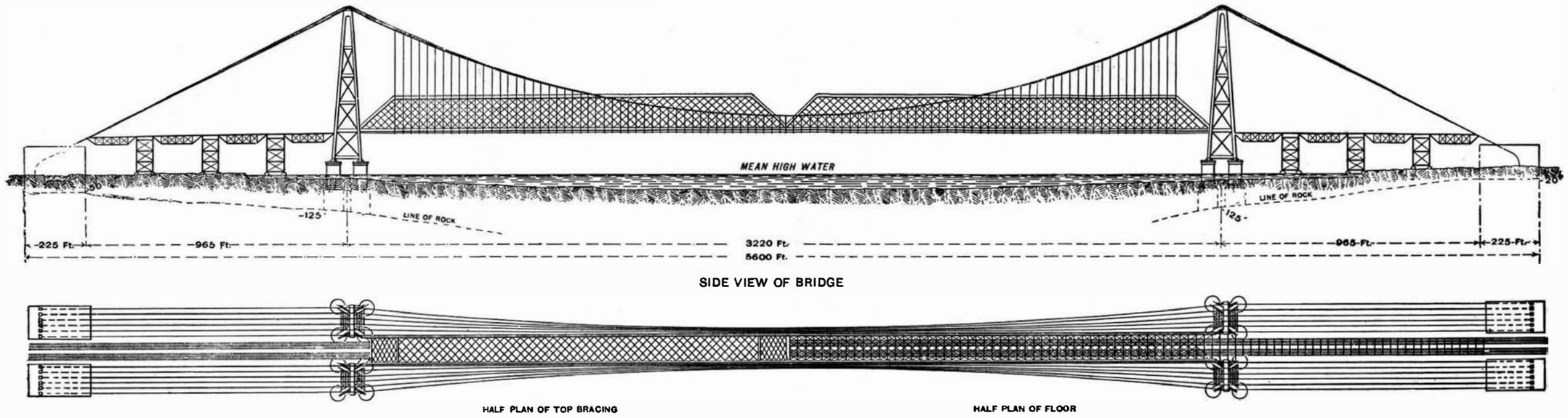
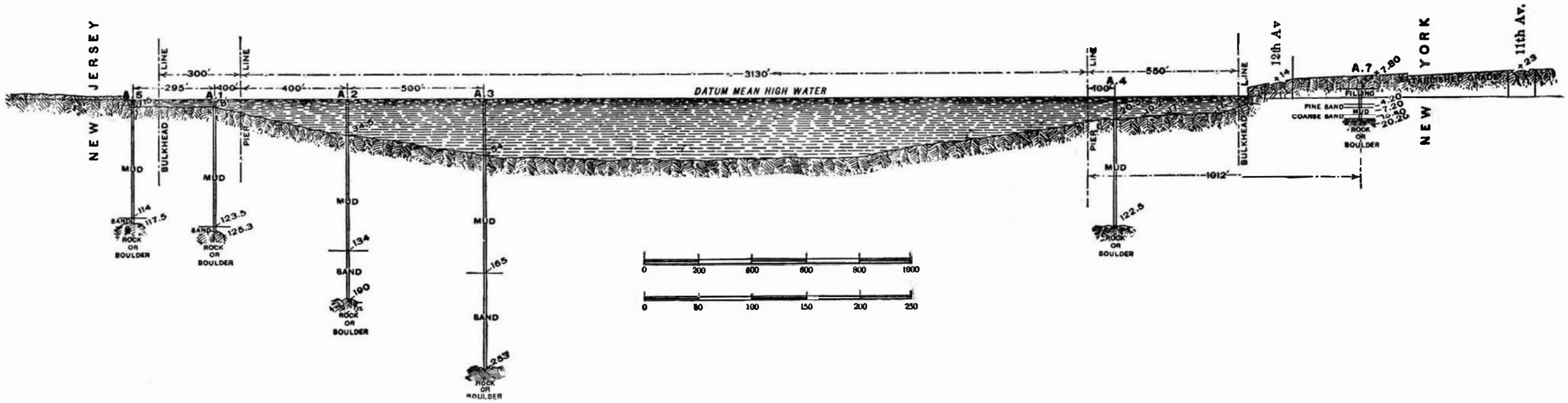


PLAN OF SUSPENSION BRIDGE, 3100 FEET CLEAR SPAN.

RECOMMENDED BY THE SECRETARY OF WAR.



THE PROPOSED GREAT SUSPENSION BRIDGE OVER THE HUDSON RIVER AT NEW YORK.

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THE PROPOSED GREAT SUSPENSION BRIDGE OVER THE HUDSON RIVER, NEW YORK CITY.

We illustrate in the present issue the general plans for a suspension bridge over the Hudson River at New York City—by far the greatest bridge of the kind ever projected. The plans are issued by the New York and New Jersey Bridge Company, they being authorized by Congress, subject to the direction of the Secretary of War, to construct the bridge in question. The bridge is to extend from a location between 59th and 69th Streets on the New York side to the opposite side of the river in Union Township, N. J.

The plans are largely self-explanatory. The bridge will have a clear span of 3,100 feet—which is almost double the span of the Brooklyn suspension bridge.

The board appointed by the Secretary of War decided that it is probable for $23,000,000 a six-track railroad suspension bridge of 3,200 feet span could be built, and it considered the amount of traffic that such a bridge would accommodate sufficient to warrant its construction.

The plans and specifications were prepared by Mr. Theodore Cooper, of this city, a member of the commission of expert bridge engineers appointed by President Cleveland, and who has since been retained by the bridge company.

The structure he proposes is a stiffened suspension bridge, the cables carrying only the part between the piers, the approaches to the main span being carried by deck trusses. The main span is stiffened by two through trusses, which may be either continuous for the entire span, or may be hinged in the middle. On the illustration the general dimensions are quoted. There is to be 150 feet head room, and, as will be seen, the river is left intact, no pier being established outside the regular pier line. The towers are to be of steel, commencing about 50 feet above high water, below which level masonry is used. The lateral and sway bracing of the main span and towers is to be of members rigid enough for compression, although some of them may normally be in tension. The general details, such as length of versed sine, the number of and the arrangement of cables, and the depth of trusses, are left to the bidders.

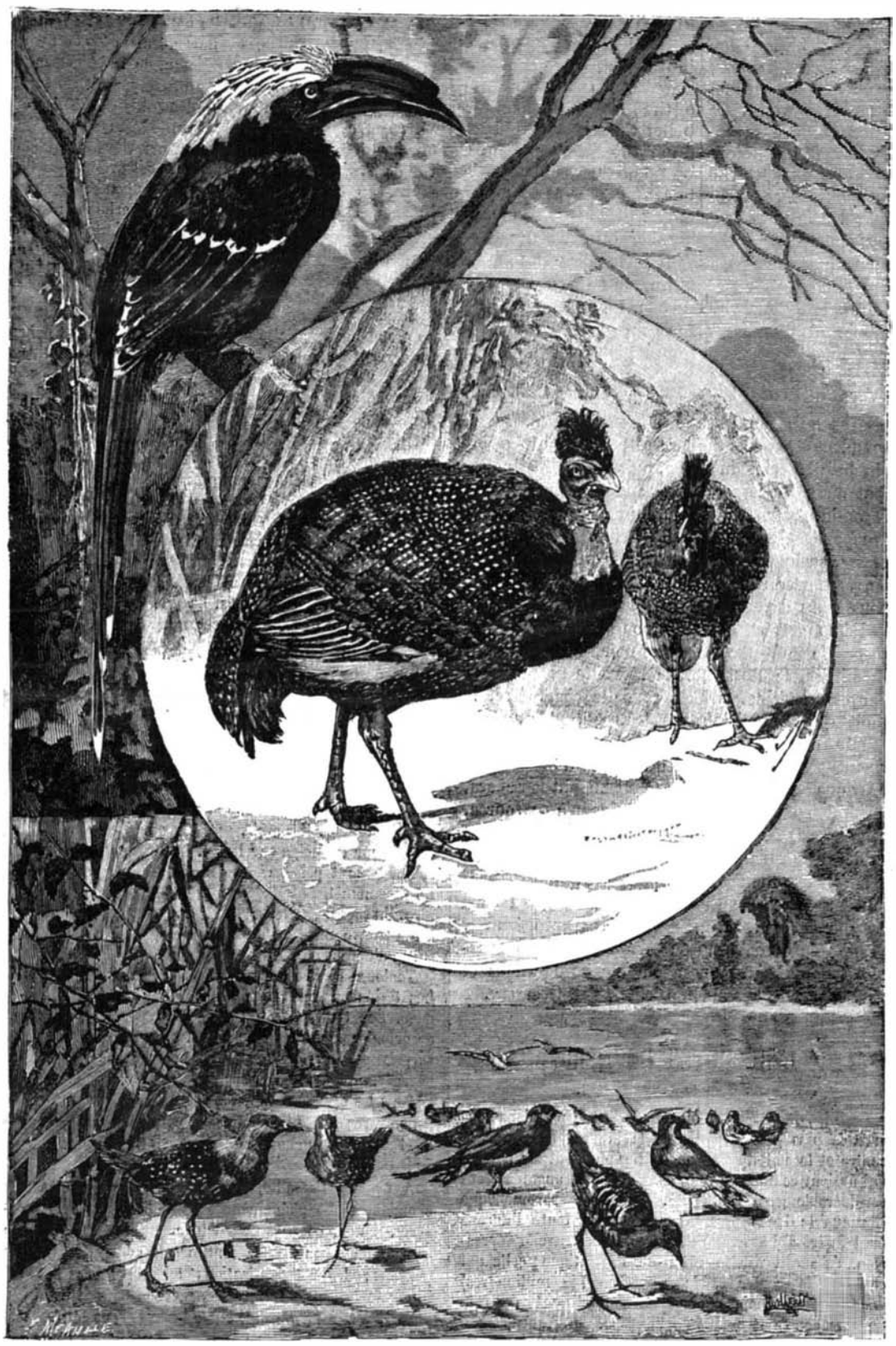
The main piers are to be carried down to rock; the foundations of the viaduct piers are left to the approval of the chief engineer. Quite an exhaustive list of strains allowed and of strengths and of coefficients in general are given. Thus for the wire in the cables a maximum stress of 54,000 pounds per square inch is allowed. In the usual construction of a suspension bridge the saddles which are on top of the towers are movable, being mounted on balls or rollers. The specifications for the proposed bridge provide that the towers and cables must be treated on the supposition that the saddles are or may become immovable. No closed forms are allowed on the bridge, all parts of which must be open for inspection. In other matters the same thoroughness appears. Thus rivet holes, if punched, must be punched too small and must be brought to a proper size by reaming.

Some space is given to the question of the cables. These are to be of straight steel wire, which must be not less than ¼ of an inch in diameter, and the wire may be twisted into ropes for compacting, or, as in the Brooklyn Bridge, may be formed by compacting the straight untwisted wires. The engineer notes that the unprecedentedly large diameter of the cables will demand that the inner strands of the cable be treated as a separate cable, around which the additional strands can be placed, squeezed, and wrapped. The wire must have a strength of 180,000 pounds per square inch and elastic limit of 90,000 pounds per square inch, and an elongation of 4 per cent in a length of one foot. Each wire must be 1,800 feet long, without weld, joint, or splice.

Such are the general features of this structure—one which when completed will be at once a triumph of American engineering and an ornament to the city.

THE BIRDS OF THE CONGO.

To pass in review here, without the aid of numerous figures, all the types of the birds of the Congo that have been made known to us by the explorations of Messrs. Dybowski, De Brazza, Schwebisch, Thollon, Petit and others, would be an almost impossible task, and an enumeration of the Latin names that ornithologists have given a host of African species that are absolutely different from those of our own country would prove exceedingly tiresome to our readers. We shall therefore confine ourselves to making known those species that are most remarkable by their form or color, the most interesting from the standpoint of geographical distribution, or the most important as regards the profit that man can derive from them. Leaving aside from among the diurnal birds of prey the vultures, fish-hawks, buzzards, falcons, etc., we shall have a few words to say of the Gypohierox Angolensis. This bird of prey, notably smaller than an eagle, slightly recalls the latter and especially the Perenopters of Egypt by certain features of its physiognomy. In fact, a circle around its eyes and the sides of its bill and at its feet are bare and of a pale rose color, and its plumage, after having been brown, passes to pure white varied with black upon the wings and tail; but its strong bill denotes affinities with the eagles that are belied neither by the attitude nor the food of the bird. The Gypohierox, several specimens of which have lived at the Zoological Garden of London, has a proud bearing and feeds almost exclusively upon fresh meat. It is met with not only in the country of Angola, but in Congo, Gaboon, on the Gold Coast, in Portuguese Guinea and in Senegambia, where it is already becoming very rare. To the south it does not extend beyond the country of Mossamedes, and upon the east coast of Africa it has been observed but once, and that at a single point, the island of Pemba, to the north of Zanzibar. It is a bird, then, that is essentially characteristic of West Africa. We shall say as much of the Scotopelies among the nocturnal birds of prey. The Scotopelies belong to the same family as our great horned owls and may be compared thereto as regards dimensions, but they differ from them markedly by the absence of egrets on the head and by the aspect of their feet, the tarsi of which are bare, and the toes of which are provided beneath with spiny papillæ, a feature that we observe only in the ospreys and the Asiatic horned owls of the genus Ketupa. Three species at least are known, which are distributed from Senegambia to the Quanza, and a single one of which, the same that inhabits Congo, has been met with on the east or rather the southeast coast, in the region of the Zambezi. They are accompanied in the west by the true horned owls, the scops-eared owls, the screech owls, common brown owls and barn owls.



BIRDS OF THE CONGO—HORNBILL, GUINEA FOWLS, RAILES, AND SEA PARTRIDGES.

In Congo the parrots are but slightly varied. Besides the gray parrot or jacko, which is observed with its squat varieties, there is hardly any but the green parrot with red forehead and shoulders (Pæocephalus ubryanus), which is everywhere rare, another species with yellow forehead (P. Gulielmi) and the small inseparable parroquet (Psittacula pullaria), which is distributed throughout the whole of equatorial Africa. As for the banded parroquet (Ps. docilis), so common in Senegambia, that does not descend so far as the basin of the Congo.

The other birds that Cuvier arranged in the order Scansores appear to be still more common in this region than the parrots, judging from the number of specimens belonging to the group of barbels, woodpeckers and cuckoos that figured in the collections received from the Gaboon and Congo by the Museum of Natural History. The barbels, which owe their vulgar name to the coarse hairs that clothe the base of the bill, which is laterally compressed and usually denticulate upon the edges of the upper mandible, belong to a dozen species of small size, and of dark brown, deep black or yellowish green plumage.

The woodpeckers make themselves remarked neither by their large size nor by the brilliancy of their colors. They are generally small and of green plumage, ornamented with red spots, with stripes or with numerous white dots upon the lower parts of the body, but in the eyes of naturalists they offer great interest, because they belong either to species that have been recently described or are still rare in collections, or to species whose area of habitat was believed to be much less extensive. The same is the case with the wrynecks, those odd birds that have the curious habit of turning their heads in all directions and bristling their feathers when they are frightened. It was already known that the common wryneck (Jynx torquilla) remains in our country only during the summer, and emigrates toward the south before the end of this season. It had been found in Morocco, Algeria, Abyssinia, Kordofan, and even in Senegal, but it was not known that it descended as far as to the Congo. Mr. Dybowski discovered it in this region, where it is met with in company with one of its near relatives, the Jynx pectoralis, of Southern Africa, which advances in

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an opposite direction on the side of the equator. The cuckoos present themselves in Congo under varied forms. Some belong to the category of golden and cupreous species that are so much esteemed as ornamental birds, and among which the foiotocole (Chrysococcyx smaragdineus) stands in the first rank; others to the category of coucals (Centropus), including species of large size with coarse and plain plumage, varied with brown, black and fawn color; and others to European species, such as the common cuckoo (Cuculus canorus), which rejoins in tropical Africa a species characteristic of the Ethiopian fauna, the Ceuthmocares æneus or bronze gray cuckoo. Finally, some of the cuckoos, and those are not the least interesting, belong to the genus Indicator, and one to the species Sparrmanni, which was observed more than a century ago, in Southern Africa, by Andre Sparrmann, the companion of Captain Cook, and the curious habits of which were described more anciently still by Father Lobo, a traveler in Abyssinia. According to Father Lobo and Sparrmann, whose assertions have been verified by Mr. Dybowski and other modern travelers, the Indicat or cuckoo or "honingwyzer" (honey guide) of the Dutch colonists, has the instinct (it would be juster to call it intelligence) of attracting the attention of the hunter by its cries, and, by flying before him, of leading him to the nest of wild bees, with the hope of obtaining a part of the booty. The Indicators are, in fact, particularly fond of the eggs and larvæ of the bee and of the adult bees themselves, and, when man is not there to lend them assistance, they address themselves, it is said, to the ratel (Ratelus Capensis), a carnivore related to the badgers, which actively hunts hymenopterous insects. In the woods in the vicinity of Franceville, trogons (Trogon narina) with golden green plumage and a bright red belly, like those that inhabit Angola, are met with, and the great forest of Mayombe, which seems to be uninhabited, so profound is the silence that reigns there during the greater part of the day, echoes toward night with the cries of the hornbills. We have not to sketch here the portrait of those odd birds with carnivalesque physiognomy, whose huge bill covers the entire face and is often further exaggerated at the top by a horny protuberance. Suffice it to say that some of these hornbills are of very large size, with a black bill, and plumage of a somber color, greenish black in the male and maroon in the female (Ceratogymnia); others of smaller size, with yellowish bill, the plumage black and white (Bycanistes); others provided with a long tail and a tuft of white feathers (Orthlophus); and others, finally, of small size, with plumage varied with black, brown, and white (Lophoceros).

Being given the nature of the country, watered by two rivers, the Agowe and the Congo, broad streams like the Aubangui, the Sangha, the Alima, and a host of watercourses of less importance, one might predict that the regions traversed by Mr. Dybowski would be infinitely richer than our country in birds of the group of kingfishers. Such is the case, in fact, and we have counted at least a dozen species living between the equator and the sixth degree of south latitude. Several of these species, it is true, are not as strictly attached to the vicinity of water, and feed upon insects and small reptiles rather than upon fishes. These are the halcyons, easily recognizable by their large red and black bill and their azure or aqua marine blue plumage, set off with velvety black. On the contrary, the Ceryles, which are much larger than the European kingfisher, and have a piebald plumage, feed largely upon fish. They appear like true giants alongside of the Corynthornides and the Ispidinæ, which are scarcely larger than wrens.

The bee eaters, which generally lay their eggs in galleries excavated in sandy banks along watercourses, and which pursue bees, wasps, and other insects through the air, are almost as numerous as the kingfishers in the basin of the Congo, where, besides the Nubian bee eater (Merops Nubiens) and the Angolan bee eater (M. Angolensis), we find the bicolored bee eater (M. bicolor), with rosy abdomen, and other species still more brilliantly colored.

Among the brilliantly colored sparrows, we may mention the blue, red, and lilac rollers, the tooracos and fly catchers, frugivorous and granivorous birds of the size of a jay; soui-mangas, which here, as in entire tropical Africa, play the role of humming birds; shrikes, with yellow or red breast; blue fly catchers; bronzed blackbirds, that have in reality nothing in common with the blackbirds, but which are true starlings, more sumptuously plumaged than ours, and, consequently, in much more demand in commerce and the feather industry. Let us not forget, either, the weaver birds, which suspend their artistically woven bag-like nests from the branches of the gigantic sycamores that grow upon the high plains. All these charming swallows, the astrilids, the bangalies, the widows and the cardinals, swarm in this region, whose tufted grasses furnish them with an abundance of food.

In addition to this brilliant assemblage, in field and forest, there flutters about a host of swallows of more modest plumage—buntings, sparrows, larks, black, gray and ruddy shrikes, ravens, warblers, bustards, ousels, gray and brown fly catchers, daws, hoopoes, etc. During fine weather, drongos, swallows, and martins perform their evolutions in the air and give chase to the insects.

Equatorial Africa is much less rich in pigeons than certain islands of Oceanica. In Congo, however, we see doves with green plumage and partly naked face (Trevon calvus), banded turtle doves (Turtur semitorquatus), pretty doves, with wings marked with metallic spots (Chalcopelia afra and C. Brehmeri), and the iron mask doves (Æna Capensis). Our partridges are replaced by francolins, which sport amid the brushwood upon the plains and in swampy places where rushes and reeds grow; and in place of pheasants, there are beautiful pintadoes, some provided with a crest like the common Guinea fowl, and others having the head ornamented with a plume or a tuft of drooping feathers. These latter (Numidia plumifera and N. cristata) are replaced beyond Bangui by the crested pintadoes (N. Marcheri), which, according to Mr. Dybowski, do not extend to the north beyond the limits of the great equatorial forest. Everything leads to the belief that these pintadoes, which are very abundant upon the banks of the Congo and Oubangui, might be domesticated, as well as the francolins, and become barnyard fowls, much superior to the lean fowls of the natives.

Large bustards (Otis Cafra) wander over the plains between the Oubangui and the Chari, whose shores are frequented by œdicnemes, gray and purple herons like those of Europe, by herons of still larger size (Ardea Goliath), by small bitterns, rails and jacanas. Anhingas (Plotus Levaillanti), commonly called serpent birds, on account of their long flexible neck, nest in numerous colonies upon the high branches of the silk cotton trees that grow upon the banks of the Oubangui, while here and there, upon the banks of sand, sport ducks of different species; Egyptian ducks, plovers, lapwings, sacred ibises, pelicans, argils, etc. A few sea birds, crossbills, so called on account of the conformation of their mandibles, ascend the Congo as far as to Stanley Pool.

It will be seen that the fauna of the Congo is as rich as it is varied. Upon studying the elements of which it consists, we recognize therein in the first place a few special forms that have not been found up to the present in any other part of Africa, and then a large number of species that descend along the west coast from the Senegambia to the Congo, and even to the Portuguese possessions, and others which ascend, on the contrary, from the Cape to the Congo through Benguela and Angola. Another category is formed of species that may be qualified as equatorial, because they are found between the tropics, from the shores of the Indian Ocean to those of the Atlantic. Afterward come a few birds which, like the Egyptian goose and sacred ibis, seem to have come from the northeast, in passing from the basin of the Nile to that of the Congo, then an important group of species widely distributed through the entire African continent, to the south of the Sahara, and another group of cosmopolite species, and, finally, intermixed with the whole, a few European birds which we are surprised to meet with so far from their own country. Among the latter, we have already mentioned the gray cuckoo, the wryneck, the gray heron and the purple heron, and to these we may add the scops-eared owl, the black kite, the chimney swallow, the fauret, the warbler, the sylvan wagtail, the meadow titling, the stone chat, the shrike, the nightingale, etc. These birds are emigrants that come to take up their winter quarters in Central Africa, some of them in crossing the Sahara, and others in ascending the Nile as far as to its source, which is not very distant from that of the Oubangui, and in following this river up to the Congo. This latter way, which is longer, but easier, is perhaps the one most followed, since the celebrated Emin Pasha found to the north of the great lakes the same European species, accompanied by many others which doubtless do not push their migrations so far, and stop in the eastern Soudan.—Le Genie Civil.

A Cheap Substitute for Selenite.

BY HANS M. WILDER.

A set of selenite plates (generally three) is an indispensable adjunct to the polarizing outfit, because of the beautiful display of colors caused by their use.

Having on a certain occasion mislaid my selenites, I looked about for a substitute, and bethought myself of trying what mica, which is stated to possess similar light-retarding power as selenite, might do. To my agreeable surprise, mica (the common stove door kind) proved to be equal to any ordinary selenite, the colors being quite as handsome. Mica possesses two advantages: It is much cheaper, a piece three inches square costing about two cents, while a selenite (the usual size of which is ⅝ of an inch) costs from one dollar up, and mica can be cut with scissors and handled without much fear of breaking it. The best way to proceed is as follows:

Put a slide of any polarizing substance (starch for instance) on the stage of the microscope, having previously put the two nicols in their places, and slip a piece of mica under the slide. Some kind of color will be observed. If not satisfactory or especially handsome, give the mica a slight turn around its axis, and try in this way whether in any position a satisfactory color is obtained. When found, cut one end square so as to be parallel with the slide; by always slipping in the mica in the same way, the same color display will be obtained, since the retarding power, and consequently the color, varies with the thickness. Quite a variety of beautiful color effects may be obtained by either using mica plates of varying thickness or by merely using two or more layers of thin plates superimposed. The colors may be varied still more by altering the relative positions of the superimposed plates; in fact, three plates of varying thickness will be all that are necessary to keep. As stated before, mica costs next to nothing. If, therefore, the first piece does not suit, throw it away and try another. Select the clearest pieces. The mica plates may be cut and mounted to suit. Personally, I prefer strips about 1½ inches wide, and somewhat longer than the stage from front to back, so as to be easily slipped in under the slide, and as easily removed.—Am. Jour. Pharm.

Street Car Compressed Air Motor.

The Rome (N. Y.) Daily Sentinel gives an account of the recent trial in that city of the Hardie air motor. A number of prominent street railway men, from various parts of the country, were present.

Robert Hardie, inventor of the motor, directed its operation. Mr. Stebbins, of the draughting department of the works, assisted in giving the visitors information. The trial was made on the 800 feet of rough track in the yard of the works, with Engineer Williams at the lever. The car started out with 1,800 pounds of air pressure to the square inch and a temperature of 310 degrees on its hot water tank, which is used to great advantage in heating the air before it passes at reduced pressure to the engine cylinders. A valve constructed for the purpose reduces the pressure of the stored air to 140 or 150 pounds, and this is the working pressure, or the pressure at which the air enters the engine cylinders. The motor starts gently, runs smoothly at a rapid rate and stops by air brake without jerk or jar. It was run back and forth repeatedly for upward of forty trips, and the test showed that under the conditions applied the motor would run twelve miles from one charging of compressed air, and make seventy stops.

The method of recharging the storage cylinders with compressed air was shown. It is a very simple operation, and, with the flexible couplings contemplated for the purpose, the recharging of a car with power need not occupy more than a minute or two. The same is true as to recharging with hot water, and the two can be done at the same time. The temperature of the hot water tank, covered with asbestos, on the occasion of the trial, was reduced from 310 to about 200 degrees in one working hour. Under more favorable conditions, especially in summer, this reduction would be much less, probably not more than half as much.

The Hardie motor and car are hung on elliptic springs, and the ease with which the car passes over wide joints, frogs or imperfections in the track is something admirable. This very important feature attracted the attention and favorable comment of the inspecting visitors from the East, all of whom know too well the terrible pounding that the trolley car gives the railroad track, because, like the lumber wagon, it is absolutely without springs. In this respect the Hardie motor indicates a sure and great saving in wear of rails and cars, while affording the utmost ease to passengers riding.

The principles of the Hardie compressed air motor are apparently above criticism. In the initial machine there are one or two minor respects—one the escape of vapor on a cold day like the breathing of a horse—in which the motor will be improved, without any difficulty, until the car shall appear as a noiseless, breathless vehicle that glides over the iron rails more smoothly than any heretofore produced, while under the most perfect control in starting and stopping.

The visitors were very much pleased with what they saw of the Hardie motor, and they watched and inspected and tallied it very thoroughly. As a result of their visit they have negotiated for the construction of six to ten of the motors to be used on Eastern lines. The order is upon certain conditions, one of which is the introduction of Pintsch gas light into the cars. This, Mr. Hardie says, can easily be done, and any other mechanical requirements can easily be met.

The air motor can be used on the simplest kind of a track. No trolleys or cables are necessary and the great expense of overhead or underground fixtures and the cost of great power plants are avoided. Besides, the economy of compressed air is greater than any other power. In electricity 60 per cent is lost; in compressed air but 20 per cent. An equipped street railway that for air motors might cost $10,000 a mile would cost many times that amount for any other system.

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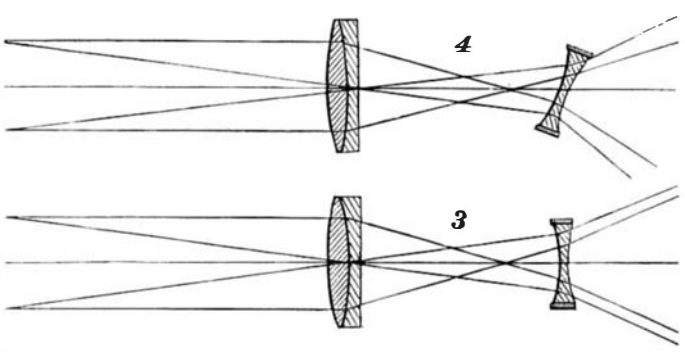
THE AUTO-PHORO-OPTOMETER.

This is an optical instrument designed for correcting errors of refraction in the human eye, and disequilibrium between any pair of its muscles.

The difficulties encountered, the profound knowledge required and long practice absolutely essential to the scientific prescribing of spectacles are little understood by the public and appreciated less.

Most persons suppose that "glasses go by numbers," and buy them as they would a pair of boots. Comparatively few consult an oculist or a prescribing optician, but those who do get their "views enlarged" in more senses than one; they learn with surprise that lenses must be made especially for them; they get a general idea of astigmatism, yet wonder how it is that a single eye may require a lens stronger in one diameter than in the others, and can scarcely believe that an eye may be "near sighted" in one diameter and "far sighted" in another. As to muscle troubles, few people know that prisms are prescribed mounted in spectacle frames.



COURSE OF THE LIGHT IN THE AUTO-PHORO-OPTOMETER.

Those who have sat in an oculist's chair and submitted to the tests in vogue remember the experience as extremely tedious, disagreeable and expensive. The "trial frame" is a trial indeed, and as the many lenses and their combinations are tried and changed the patient's eyes become so strained and fatigued that his answers are very unsatisfactory, and the result is often an imperfect "fit," even though the oculist be a man of unquestioned eminence and ability. Such a man will not deny the truth of this paragraph. What then are the chances for accurate work at the hands of a "prescribing optician"? He has not the thorough knowledge of the oculist. He is a busy merchant, and besides he charges no fee for his examination and cannot devote much time to the case. Yet the prescription work done by opticians to-day is largely in excess of that which reaches the oculists. In fact a new profession—a very profitable one—is rapidly growing up, and seems destined to take its place by the side of dentistry. It is ably represented by the most advanced opticians, many of whom prefer being known as "refractionists." A notable movement has recently occurred in Boston, where the New England Association of Opticians has been successfully inaugurated, with a large and constantly increasing membership.

The instrument here illustrated has been exhibited at one of the meetings of the New England Association of Opticians by its inventor, Dr. Homer A. Huntington, who in an able lecture demonstrated the correctness of its principles and the simplicity and rapidity of its action. It is so nearly automatic and so thoroughly under control of both the patient and the operator as to be susceptible in a moment to very "fine" adjustment. Primarily the instrument is a small telescope mounted upon an upright stand. The lenses are those common in opera glasses, with the difference that two auxiliary interchangeable eyepieces are used in correcting myopia (near sight), and the minus lens of the ordinary eyepiece is so arranged as to tilt upon an axis at right angles to the principal optical axis or line passing from a distant object centrally through both lenses. This eyepiece, a, also revolves in common with the disk, A, so that it can be tilted in any plane, i. e., at any angle from 0 to 180. The tilting of this lens is entirely new in optics. The aberration so caused has been recognized only as a thing to be carefully avoided in the placing of lenses in optical instruments. That the tilting of a lens of certain power at a given angle is equivalent to the employment of a cylindrical lens, the inventor claims as the discovery of a new principle, doing away with the employment of a multiplicity of lenses and yet indicating them all, and rendering the correction of astigmatism as simple as the measuring of liquids.

DR. HUNTINGTON'S AUTO-PHORO-OPTOMETER.

Those familiar with the subject will find no difficulty in understanding the remaining parts of the instrument. In testing for hypermetropia, the draw tube is closed, 0 being indicated on the outer circle of figures, which are white; on revolving the disk, B, an outward movement is communicated to the draw tube, which can be opened to the extent when + 10 are indicated. Should the case be one of myopia, one of the auxiliary eyepieces, —10, is used, and the values are indicated on the inside scale (red) of the disk, B, which is revolved in the opposite direction from what it is in testing for hypermetropia. Should the case be one exceeding —10, then the other auxiliary eyepiece, —20, is used, so that the entire range of the instrument is from +10 to —20 for the distance type, printed with appropriate type to allow for the magnifying power of the instrument, which practically is not a disadvantage.

Muscle testing by the phoro-optometer is exceedingly simple, and is based on the principle of decentering, esophoria and exophoria being indicated by the pointer and scale on disk, C, and hyperphoria on the quadrant, D.

The most important claim for this instrument is that it requires no skill and that any one of average intelligence can do as accurate work with it after the third day as the most accomplished optician with the old trial case can do after as many years, and in one-tenth of the time. In the words of the inventor, "What steam is to travel, what the telephone is to speech, is the auto-phoro-optometer to dioptrics." A very important point consists in the fact that the instrument forms with a screen an excellent artificial eye, invaluable to the student. Fig. 3 shows the course of the rays in a Galilean telescope or opera glass, and Fig. 4 shows the effect on the light beam of tilting the negative or eye lens. In the position shown it becomes practically a negative cylindrical lens.

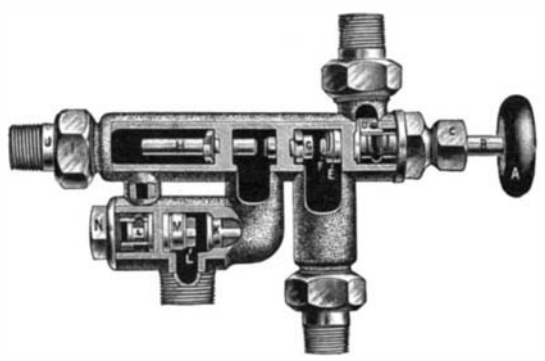
Business communications regarding this instrument may be addressed to Mr. A. G. McKenzie, optician, 156 Charles Street, Boston, Mass., who has acquired an interest in the invention.

THE INTERNATIONAL INJECTOR.

We illustrate herewith in perspective and sectional views a new injector for which the makers claim most excellent results. It has been designed to combine all the good features of both automatic and positive injectors of the past, and is claimed to surpass both in working qualities. The principal new feature in the International is the fact that the current of water to the boiler is established against atmospheric pressure instead of against direct boiler pressure as heretofore. This is accomplished by the combination of overflow valve, K, and pressure valve, L. When the injector starts, the steam passing through the steam jet, F, and suction jet, G, passes down through the overflow chamber, forcing valves, K and L, away from their seats and opening the passageway through the overflow for the escape of steam, which by its pressure against the valve, H, holds both valves away from their seats.

A vacuum being created between jets, F and G, the water is lifted, and passing through the suction jet, G, and combining and delivery jet, H, on its way to the boiler, passes down through the secondary overflow, and out through the passageways between pressure valve, L, and pressure valve collar, M. As the pressure increases in the delivery chamber around the delivery jet, H, valve, L, is gradually forced to its seat against the collar, M, but does not finally close until the current to the boiler is firmly established. The valve, K, in the meantime is closed by the vacuum in the overflow chamber. By a new construction of the parts in the steam chamber, the same valve handle, A, opens valve admitting steam to the injector, and at the same time regulates the amount of water supply, therefore no valve is required in the suction pipe, nor is one necessary in the steam pipe except as a convenience, should it be desired to remove the injector at any time while carrying steam on the boiler. The combination and delivery jet, H, has no spill holes.

The makers claim for this injector that it will start at 13 to 15 pounds steam pressure and work from that point up to 250 pounds steam pressure, giving it a range of 235 pounds, and that it is automatic and restarting at any and all pressures. It lifts the water vertically 20 to 22 feet, and handles a hot water supply of 135 degrees at 65 to 80 pounds of steam, 125 degrees at 125 pounds of steam. By delivering the minimum capacity it will put water into the boiler at 200 degrees at 80 pounds steam, and at 260 degrees at 150 pounds to 200 pounds of steam, the water being taken from a 4 foot lift at 74 degrees.

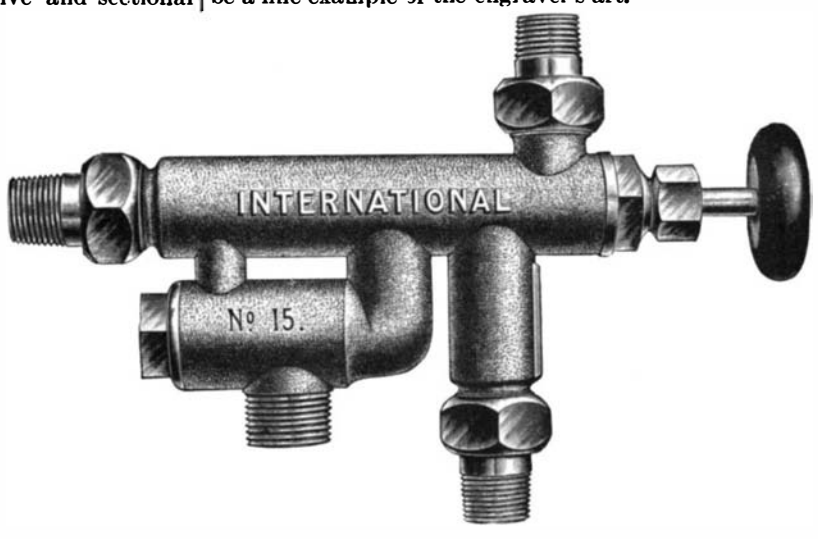


INJECTOR—SECTIONAL VIEW.

The parts are made interchangeable and are all easily accessible for cleaning, and the injector is fully guaranteed. It is manufactured by the World Specialty Company, 113 Seventh Street, Detroit, Mich.

The Columbian Exposition Awards.

The Director of the Mint says that the medals which were awarded to the exhibitors at the Columbian Exposition of 1893 will be ready for distribution about June 1. The superintendent of the Bureau of Printing and Engraving says that the diplomas will be finished about the end of March. The long delay has not been borne very patiently by those who are to receive the awards, and was caused by the rejection of the design for the reverse of the medal by the Quadro-Centennial Committee. The medal was designed by the sculptor Augustus St. Gaudens. After its rejection, a new design was prepared by Charles E. Barber, of the United States Mint, so that the medal as issued will be the joint work of Messrs. St. Gaudens and Barber, the former doing the obverse, the latter the reverse. The 23,700 bronze medals are to cost $30,000. If, however, any exhibitor should prefer a gold medal he is authorized to have one, provided he pays for the gold himself. The medals will all be alike, except for the names of the exhibitors inscribed on them. The diplomas will be about 22 by 18 inches in size, and the design was made by Will A. Low, an artist of New York City. It will be a fine example of the engraver's art.



AN AUTOMATIC INJECTOR ADAPTED TO WIDE RANGE OF PRESSURE.

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Apoplexy.

We make the following brief abstracts from an interesting article in the Medical Record by Charles L. Dana, M.D., of New York City, entitled "Some New Observations upon the Causes, Mode of Onset, and Prognosis of Apoplexy:"

Many writers have based their statements upon statistics which have been handed down from the now somewhat venerable records of French and English hospitals and from the systematic writers on this subject of half a century ago. In this country, at least, there has not been, so far as I know, any extended critical analysis of large numbers of cases of cerebral hemorrhage or of acute softening.

The total number of cases I have utilized for study is 182, of which 100 were non-fatal and 82 fatal.

One-third of the cases are in females, and the special apoplectic age is between forty and fifty years. Three-fourths of all adult apoplexy occurs between the ages of thirty and sixty, being pretty evenly distributed between the fourth, fifth, and sixth decades. If one were to leave out syphilitic cases, however, we should find that the most serious decade was that between the fifty-first and the sixtieth year. After the age of seventy apoplexy is relatively rare and is little to be feared.

Taking hemiplegia as a whole, I find that a very distinct history of syphilis was found in 36 out of the total 100 non-fatal cases. In 4 the attack was due to the puerperium; in 1 it followed typhoid; in 5 the patients worked in lead or were painters; in 1 there was Bright's disease; in 5 there was a severe cardiac trouble; in 5 the patients were drivers and heavy drinkers; in 10 others exposure and heavy drinking were striking elements in the history.

This accounts for two-thirds of the cases, one of these thirds being syphilitic. This fact that syphilis causes one-third of all cases of apoplexy has not, I think, been heretofore brought out, though I feel sure that the experience of neurologists will confirm it.

If a person has not had syphilis and is not a drinker, the chances of his dying of apoplexy are very greatly lessened. The remaining one-third of the cases has still to be accounted for, and this third includes, for the most part, I believe, cases of intercranial hemorrhage, rather than softening. The most important factors here are heavy eating, with insufficient exercise, and some congenital tendency to arterial disease due to a gouty or rheumatic diathesis. Excessive mental work does not lead to apoplexy, and brain workers do not die of this disease unless they are intemperate in eating, drinking, and perhaps in smoking, though on this latter point I feel doubtful. Two of my cases only gave a history of excessive use of tobacco as the sole predisposing cause. It is often stated, and is commonly believed, that one attack of apoplexy predisposes to another, and that a person who has had a vessel broken or occluded is extremely liable to have a second attack within two or three years, but the frequency of repeated attacks seems from a study of my cases to be much exaggerated.

It is, I have no doubt, the experience of many that persons who have had a moderate attack of cerebral hemorrhage may live for many years in fairly good health.

The conditions of modern civilization undoubtedly are tending to increase the number of cases of apoplexy, particularly those due to rupture of blood vessels. The fact that under better sanitary conditions more people reach the apoplectic age is one cause of this. The gradual lessening of the number of acute infectious fevers and the consequent lessening of mortality from such diseases increase the proportionate number of deaths due to diseases of the arterial system; in fact, the stress of modern civilization shows them more, so far as organic disease is concerned, upon the arteries than it does upon the nervous system. The increased opportunities for indulgence in luxurious modes of living, and in excessive eating and drinking, tend to impair the integrity of the coats of the arteries, and to promote conditions of arterial fibrosis. Already this fact may be demonstrated by the statistics of our great cities, as well as deduced from the known laws of pathology.

In New York City the deaths from apoplexy and paralysis have increased from 314 in 1866 and 272 in 1867 to 1,194 in 1892 and 1,171 in 1893.

The deaths from these causes between the ages of twenty-five and sixty-five have increased from 219 in 1866 and 197 in 1867 to 939 in 1892 and 931 in 1893.

Here the deaths from apoplexy and paralysis have quadrupled, while the total death rate has increased from about 25,000 to a little over 40,000, i. e., it has about doubled.

As to the exciting causes of attacks of apoplexy, some misapprehension apparently prevails. We all know that many fatal cases occur in persons who have been on a drunken spree, and that of all exciting causes of fatal strokes alcohol is the most potent. On the other hand, in my experience very few attacks take place, as is currently supposed, during some especial mental or bodily strain.

The frequency with which attacks occur in the morning after breakfast, or in the evening, is somewhat noteworthy. Few cases occurred in the middle hours of the day.

The apoplexies are increasing in disproportionate frequency, owing partly to the facts: that more people live to the apoplectic age; that there is a larger urban population, with all that that implies in regard to the use of alcohol, the prevalence of syphilis, and the greater intemperance in eating and working.

Apoplexy does not especially affect brain workers if they live temperately, but rather spares them.

Apoplexy is sometimes a conservative agent, calling a halt to excessive activity and intemperate living, and actually prolonging life.

About one-fourth of those stricken with apoplexy die from the attack (hemorrhages being the most dangerous, thrombosis, especially syphilitic, being least so).

The average duration of life of those who have and survive one attack is over five years. The chances of a second attack before the fourth year are always considerable, yet do not amount to fifty per cent, and are inconsiderable so far as hemorrhages are concerned. Thromboses are much more apt to recur than hemorrhages.

The Production of Camembert Cheese.

The popular small cheeses made in France and Germany, but used everywhere, being largely exported from these countries, are divided into two classes—one is used within a few days after the making, the other being cured for later consumption. It is plain that the latter description of cheese is more suitable for extensive manufacture on this account than the older kind, known as fromage frais, and, on account of the greatly improved quality, the cured ones are known as fromage fin. This term is fully justified by the most careful process of curing, by which the sharper ammoniacal taste and odor are got rid of, and a soft, rich, buttery consistence and a pronounced and pleasant flavor are given by the slow and careful curing. It is a noteworthy fact that this method of curing, which has been in use for more than a century and has been slowly evolved by gradual experience, is based on the most correct scientific principles. A typical cheese of the cured kind is the Camembert, so called from the place of its original manufacture, where it was first made in the year 1791 by a dairyman named Peynel. The manufacture now amounts to several millions of cheeses annually, and employs the whole population of this district. The method of manufacture of this popular cheese is exceedingly delicate and demands the greatest care in the most minute details, beginning with the milking of the cows—indeed, before this, for the feeding and lodging of them are fully considered in respect of the avoiding of everything that might interfere with the perfect purity of the milk and the preservation of all the fine qualities of the pasture of this especially favored district. This extreme care accompanies all the work in the dairy until the milk is finally and carefully strained. The milk having been drawn, is strained immediately, and is set apart for three hours for the cream to rise. There is then a thin pellicle of cream on the milk, which is removed and churned into a very fine quality of butter. The milk, for the convenience of the special manipulation, is set in broad earthen jars, each holding five or six gallons, and, as each has been skimmed, it is set on a heater and warmed until the common well-known pellicle or skin forms on the surface and wrinkles or creeps as it is called. The temperature at which this happens is somewhat over one hundred degrees. The rennet is then added, one tablespoonful to each jar of milk, in which there are twenty liters, equal to about twenty-one quarts. The rather high temperature of the milk when the rennet is added brings the curd quickly, and at the end of five or six hours each jar is set on a low bench, in a sloping direction so as to bring the contents to the extreme edge, and the curd is then dipped out into the moulds, which are of cylindrical shape.

These moulds, made of pure tin, are twelve centimeters or four and three-quarters inches high and wide. They are open at each end and are set on mats of rushes sewn together. The moulds are filled with the curd, from which the whey drains through the rushes on to the sloping table, around which a groove is cut to carry it to the drain by which it flows away. As the whey drains from the curd, this shrinks in volume until the cheese has gained sufficient consistency to be handled out of the mould, which is at the end of the second day. They are then taken out of the moulds and sprinkled with salt and left on the mats three or four days longer. They are then placed in shallow wooden boxes with handles and are in this way removed to the drying room. Here they are arranged on frames, of which there are several tiers, and are exposed to a free circulation of air regulated by swinging shutters. These windows are not glazed, but they are protected by fine wire gauze to keep out the flies, and, as the direction of the wind varies, so the shutters are opened or closed fully or partially in such a manner as to direct the air currents over or under the cheeses lying on the lathed frames, through which the air has complete access to the cheeses. Here they remain from twenty to twenty-five days, according to the weather. They are then removed on large movable shelves to the curing cellar, where the circulation of the air is much increased by the management of windows similar to those previously described and the shutters fitted to them. At this time the fermentation in the cheese begins to throw off moisture which gathers on the surface of the cheese. At this stage the cheeses are removed to the finishing cellar, in which the windows are glazed and protected by inside blinds. In this place the cheeses remain a month or less, as the ripening may progress slowly or rapidly. During this time they are turned once in forty-eight hours. This constant turning is a special process for the fullest exposure of the cheeses to the air, and is practiced all through the curing, gradually increasing the time of the turnings if the ripenings may be proceeding too quickly. At the end of the term the cheeses are complete, and are packed in paper and put into boxes. They are then packed into wicker baskets and sent to market. They weigh about eight ounces and sell for about one shilling and sixpence each. The finest selected cheeses are sent to special customers who pay one-fourth more. The prices vary as the season or the demand and supply, but usually they remain about the same for years. Such a desirable cheese as the Camembert is, of course, imitated and sold at a less price, but on account of the strict way the French government has of controlling such things, the imitation is sold for what it really is, as fromage façon Camembert, which does not deceive the purchaser in any way.—Journal of the Society of Arts.

The Astronomical Programme for 1895.

C. A. YOUNG.

The astronomical programme of the year, so far as it is a matter of prediction, offers nothing of exceptional rarity or interest.

The number of eclipses is somewhat larger than usual, but three of the five are only small, partial eclipses of the sun, and are all invisible in the United States. The two eclipses of the moon, however, which occur on March 10 and September 3, are both total, and are both visible in this country from beginning to end. The first of them is also observable in Europe, and will therefore afford an opportunity for co-operative observations of the occultations of small stars that lie in the moon's path while it is obscured—observations which are of great value in determining the distance of the moon and the form and size of the earth. This year, also, the moon every month passes over the Pleiades, and their occultations possess the same value if observed at widely separated stations.

The sunspot maximum was reached two years ago, and the activity of the solar surface is now declining, so that there is no reason to look for any phenomena of special interest in that quarter for the present.

As for the planets, Mars is already far away, and for more than a dozen years will not again be as favorably situated as he was last autumn. Saturn is far to the south, and even at his opposition in April and May will be too low down for satisfactory observation. During the first three months of the year Jupiter, on the other hand, will be admirably placed and will monopolize the interest of observers; and during the spring and summer Venus will be splendid in the evening sky.

The only periodic comets whose return is due this year are Encke's and Brorsen's. The former, which completes its orbit every three and a third years (the shortest comet period known), came in sight early last November, but does not reach its perihelion until February, and is still under observation. It is very faint, seldom becoming visible to the naked eye, and the chief interest that attaches to it lies in the strange continual shortening of its period, a phenomenon which still remains without any certain explanation, though very generally supposed to be due to its collision with some invisible meteoric swarm. Brorsen's comet, which made its last visit in 1890, and has a period of five and a half years, is due again next summer; but it is unfavorably situated, and will be so faint that it may very possibly elude observation.

Of course, it is perfectly possible, and much to be desired, that some great comet may appear entirely unannounced, or that some "new star" may unexpectedly burst into brilliancy; but such phenomena do not come within the range of our prediction.

Probably before the close of the year the immense forty-inch telescope of the Chicago University will be erected in the magnificent observatory now building for it at Lake Geneva, Wisconsin; and it is possible that by that time the great instrument now being constructed for the observatory of the Cape of Good Hope may also be mounted, so that hereafter the southern hemisphere may possess at least one instrument comparable in power with those that are now so numerous in the northern. And yet, after all, the real progress of astronomy depends more upon the unobtrusive, faithful, laborious work of the mathematicians and routine observers than upon big telescopes and sensational discoveries.—Cosmopolitan.

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RECENTLY PATENTED INVENTIONS.

Railway Appliances.

CAR COUPLING.—Clement Mire and Paul Judice, Jr., Donaldsonville, La. The drawhead of this coupling may be of the ordinary form, and the coupling bar has at each end an arrow-like head adapted to engage pivoted coupling hooks, which are arranged in pairs in each drawhead, adjacent to pivoted detachers. The latter are formed with ejecting portions for forcing the coupling bar out of engagement with the coupling hooks, and the coupling hooks have rear arms engaged by operating levers with connections which may be extended to the top or side of the car.

SWITCH.—John M. Perkins, Brooklyn, N. Y. This inventor has devised a switch of simple and inexpensive construction, the actuating devices acting directly upon the switch point, the movement of which may be effected from a moving train. In connection with outer and inner guards adjacent to the main rail and the switch point, in a block at each side of the latter, is pivoted a somewhat crescent-shaped lever, the levers engaging opposite sides of the switch point, and being adapted for engagement by any trip which may be pressed downward from a moving train. To locate the shifting device centrally between the track rails, a shifting tongue is pivoted on a plate between guards, in each of which a triangular lever is pivoted, the free end of the tongue being connected by a link with the switch point, and the movement being likewise effected from the train.

SWITCH.—William L. Geisler, Hempstead, N. Y. This improvement is especially adapted for street railway service, the switch being readily shifted by an operator on a moving car. A switch tongue is pivoted on a slotted cover plate, two pivoted bent levers extending through the slots, while a pivoted tilting arm supported from the plate has near each of its ends an anti-friction roller, there being a connecting device between the tilting arm and the switch tongue. In a bracket depending from the car are held rollers which may be depressed by foot pressure on a presser bar at either side to throw the switch tongue in the direction desired to switch the car from one track to another.

Electrical.

CONDUIT RAILWAY.—Michael F. Flynn, Stamford, Conn. According to this improvement a small surface conduit on which is the trolley rail carries the live wire in such a way as to prevent grounding and loss of current, tilting levers being arranged below the live wire to carry it upward against contact screws, while an operating mechanism extends up through the conduit whereby the levers are actuated by a passing trolley. The construction is very simple, and the trolley rail is entirely out of circuit except the moment that the car is in connection with a certain section.

Mechanical.

CENTRIFUGAL PUMP.—Warren P. De Remer and Josiah Peeper, Western Union, Wis. This invention provides self-adjusting movable nozzles on the ends of the pump discharge pipes, the arrangement being such that the priming-holding nozzles automatically adjust themselves to securely hold the priming in place until the centrifugal force becomes greater than the atmospheric pressure, and then permit a free and natural escape of the water without undue friction and resistance, effecting a saving in the power required to drive the pump.

MACHINE FOR TAPPING MAINS.—John Hearne, New York City, and Elmer E. Cisco, Brooklyn, N. Y. This is a gas-tapping machine, adapted to be fastened upon a pipe for drilling, reaming, and tapping a hole without allowing any gas to escape, the tapped hole being closed by a plug. It has a hollow, exteriorly threaded body adapted for air-tight connection with the pipe, there being a feed mechanism and a tool operated therefrom in the hollow body, and a hand wheel screwing on the exterior screw thread of the body. The machine is light and strong and may be readily applied to and disconnected from a pipe.

Agricultural.

CULTIVATOR.—Horace S. Overstreet, York, Neb. This is a machine for cultivating an unplanted field, serving substantially as a harrow, or it may be employed for cultivating two rows of corn at one time. It has gangs of cultivators which may be independently raised or lowered, the outer gangs adjusted as to depth and the intermediate gangs serving as a drag, and its draft mechanism is so arranged that the poles may be directed to the right or left, causing the team to properly guide the machine. The gangs of cultivators are firmly held, so that they will not have lateral movement, and a draft equalizer is utilized, whereby undue tension will be removed from the team, the three horses employed each drawing equally.

MOWING MACHINE ATTACHMENT.—William C. Carlton, Rockville, and Charles H. Sebree, Caldwell, Idaho. This is a cutter attachment, applicable to an ordinary mower or reaper, in which a vertically reciprocating cutter bar is arranged at the outer end of the ordinary horizontal cutter or sickle bar. In its operation, while the machine is moving in the ordinary way, the vertically reciprocating cutter divides the grass at one end of the main cutter or sickle, so as to leave the swath clear and well marked, the grass being cut vertically at the end of the main finger bar, obviating the difficulty experienced with the ordinary mowing machine, where heavy grass drops down over the swath which has been cut.

Miscellaneous.

CARBURETOR.—Harry B. Cornish, Hampton, Iowa. For carbureting air, that it may be burned as a gas for an illuminant, this inventor has devised a simple apparatus for use in connection with a gasoline tank, to incorporate with the gasoline a volume of air, the apparatus being safe and easily controlled. An upper gasoline tank is connected by a valved pipe with a lower tank, to which air is supplied under pressure, the gasoline dripping down through the pipe by gravity to the lower pipe, passing through a series of screens in the lower tank, and both tanks being connected by a valved pipe arranged to maintain an equal air pressure in both the upper and lower tanks, there being an outlet for the carbureted air in the pipe connecting the tanks.

DISTILLING AMMONIA.—Samuel J. Whiteside, Savannah, Ga. An apparatus for use in connection with absorption ice machines has been devised by this inventor, whereby the ammonia is economically and thoroughly rectified before being expanded into the bath, and the boiler feedwater raised to a high temperature, thus saving fuel. The apparatus comprises a stack of three sets of novel rectifying pans in a rectifier set on top of the ammonia boiler, and is provided with a heater through which passes the feedwater under boiler pressure, there being in the heater a steam coil connected with the heating coil in the ammonia boiler, a second coil for the ammonia gas and connected with the rectifier, and a third coil connected with the weak ammonia in the ammonia boiler.

COAL DISCHARGING TRAMWAY.—John B. Honor, New Orleans, La. This is a sectional construction which may be set up anywhere and made as long or short as required, being primarily adapted for unloading coal from steamers along a river front. The dump cars for operation in connection with the tramway are so connected with a winch that, when one car has been unloaded, a return of the empty car will cause the loaded car to travel to its destination, the cars being automatically dumped on reaching the desired point and held open until all of the contents have been emptied.

WINDMILL REGULATOR.—Richard T. Skinner, Eldora, Iowa. This is a simple and positively working apparatus governed by the movement of a float, the lowering of which sets the windmill and pump working, while its raising throws the mill out of gear, the movements in both cases being gradual and easy. An arm projecting from a ratchet wheel engages a controlling wire of the mill and an oscillating lever is connected with the pump rod, a pair of pawls on opposite sides of the fulcrum of the lever being adapted to engage the ratchet wheel, while a notched tie bar connects the pawls and a tilting latch is adapted to engage the notch of the tie bar and hold the pawls released. A swinging float-controlled lever strikes and releases the latch.

DEVICE FOR DRAWING ALE.—Charles G. Reers, Jersey City, N. J. This improvement is designed to facilitate the drawing of ale in a glass without foam. A suitable receptacle is divided by partially perforated partitions into three compartments, the upper one normally for gas, the second one for foam, and the lower and larger one for the solid ale. The middle compartment is connected by pipes with supply casks of ale or with the ale pump, so that the ale passing down to the lower compartment will be almost without foam, and from low down in this compartment a pipe having a draw faucet is extended to the bar. The upper compartment is provided with an air and gas vent, to be opened from time to time as may be necessary.

PAPER PERFORATING MACHINE.—Clay W. Holmes, Elmira, N. Y. This invention relates to slot perforators in which a circular female die has a peripheral slot receiving a series of short cutters carried by another circular die to punch elongated slots in straight line series from a sheet of paper. The improvement provides for a series of clearing blades arranged to run in the slots of the female die in tangential position, being adjustably held therefor by means of collars on a countershaft. These blades may be applied to any set of dies working on the continuous slot principle, and operate to effectually remove the little bits of paper cut out, which tend to pack in the slot so as to stop the operation of the machine.

ATOMIZER.—Albert Heinz, Brooklyn, N. Y. This is a simple device designed to be especially serviceable to physicians desiring to spray an affected part of the body for a short time only, in cases where only a single spray is required or desirable. It is arranged to cause the spray to cease immediately whenever the operator releases the pressure on the bulb, the liquid in the discharge nozzle then receding slightly from the orifice.

BICYCLE LANTERN BRACKET.—John C. Wells, East Hampton, Conn. This device comprises a length of wire doubled upon itself and bent outwardly at its closed end to support a lantern, a clip having eyes at one end receiving the bracket arms, while at its opposite end is a swinging bolt with a saddle, a nut clamping the saddle on the bracket ends. The device is very simple and may be readily adjusted to various sized heads or quickly detached therefrom.

LAMP BURNER.—Daniel T. Fox, Mount Pleasant, Pa. This invention relates to burners formed in two sections, one section carrying the wick tube and the other the chimney, and provides means for conveniently adjusting the top section to an elevated position and locking it there. By means of a lever pivoted to the lower section a combined lifter and prop may be made to elevate the upper section and chimney so that it will not accidentally drop as the lamp is being lighted or extinguished.

DUST PAN.—Kent W. Gress, San Francisco, Cal. This pan has a long handle which may be adjusted for different positions by means of a spring wire connected with the rear of the pan and formed with fingers which slide in grooves low down in the handle, there being transverse holes at each end of the grooves. The pan is preferably formed of a single sheet of metal, the back and top being formed of a continuation of the metal of the bottom, thus making a dust pocket in the rear.

SHOE FASTENING.—Alfred J. Waggett, Brighton, England. According to this improvement a knob-headed stud is movable in a slot coinciding in direction with the line of strain, a plate pivoted in or near the line of strain having notches at different radial distances to engage with the neck of the stud, and both stud and locking plate being applied to one flap, while a rod or arm is fixed along the edge of the other flap and a button hole is made in the flap behind the rod to engage the stud.

PRICE CARD HOLDER.—John Koehler, New York City. This device comprises a clamping section with slotted head at its upper end and an integral pintle, while a ticket-carrying section has an integral knuckle entering the slot and turning on the pintle. It is adapted for attachment to various articles, especially to cigar boxes, to indicate the name and price of cigars.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

ELEMENTARY LESSONS IN ELECTRICITY AND MAGNETISM. By Silvanus P. Thompson. New edition, revised throughout, with additions. New York and London: Macmillan & Company. 1895. Pp. xv, 628. Price $1.40.

Professor Thompson's previous edition of this book had so wide a circulation and was so popular and useful that the present very elegant new edition, brought very well up to date, will be warmly welcomed by electrical students. In turning the pages over the appositeness of the illustrations and the way they are applied to illustrate the subject immediately appear in the most favorable light. A quantity of problems and exercises and a most excellent index close the work. It is always a comfort to find a work of this sort published in England with no reference to such a thing as a syllabus.

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SCIENTIFIC AMERICAN BUILDING EDITION.

MARCH, 1895.—(No. 113.)

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3. A cottage at Great Diamond Island, Me., recently erected for H. M. Bailey, Esq., two perspective elevations and floor plans. A unique design for an island cottage. Mr. Jno. C. Stevens, architect, Portland, Me.
4. A dwelling at Armour Villa Park, N. Y., recently erected for J. E. Kent, Esq., at a cost of $5,200 complete, two perspective elevations and floor plans. A very picturesque design.
5. A colonial cottage at New Rochelle, N. Y., recently erected for C. W. Howland, Esq., two perspective elevations and floor plans. Mr. G. K. Thompson, architect, New York City A unique example of a modern dwelling.
6. The residence of Charles N. Marvin, Esq., at Montclair, N. J. A design successfully treated in the Flemish style. Two perspective elevations and floor plans. Mr. A. V. Porter, architect, Brooklyn, N. Y.
7. A fine Colonial house at Elizabeth, N. J., recently completed for Henry A. Haines, Esq. Perspective elevation and floor plans. Architects, Messrs. Child & De Goll, New York City.
8. A residence at Flatbush, L. I., recently erected for C. H Wheeler, Esq., at a cost of $11,000 complete. Two perspective elevations and floor plans. Architect, Mr. J. G. Richardson, Flatbush, L. I. An attractive design.
9. A cottage at Plainfield, N. J., erected for Chas. H. Lyman, Esq., at a cost of $5,000 complete. Two persective elevations and floor plans. Architect, Mr. W. H. Clum, Plainfield, N. J. A picturesque design.
10. An elegant house at Scranton, Pa., erected at a cost of $15,000 complete. Two perspective elevations and floor plans. Architect, Mr. E. G. W. Dietrich, New York City.
11. Engraving showing the new building of "The Bank for Savings," recently erected on 22d Street, New York City. Mr. C. L. W. Eidlitz, architect, New York City.
12. Foundation piers of the American Surety Company's building, New York City. Four illustrations, showing the most advanced methods of caisson construction for city buildings.
13. Miscellaneous contents.—An automatic gas saving governor, illustrated.—Heating a residence with open grates, illustrated.—Arranging effective interior, illustrated.

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References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
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Minerals sent for examination should be distinctly marked or labeled.

(6446) E. L. K. asks: 1. How would you graphically represent the potential wave in secondary of an induction coil? A. It depends on the construction of the coil, and the determination may involve quite delicate calculations. For general alternating current work we recommend and can supply Kapp's "Alternating Currents of Electricity," price $1; Blakeslee's "Alternating Currents," price $1.50; Tesla's "Experiments with Alternating Currents," price $1, by mail. 2. How is the permanence of different kinds of iron measured? A. By determining the relative traction in identically shaped samples under identical conditions of magnetizing force (ampere turns). See S. P. Thompson's "Lectures on the Electro-Magnet," $1 by mail.

(6447) A Tropical Plant Sent from Nebraska.—The fleshy leaves and peculiar bell-shaped flowers of greenish hue, with purplish shadings, sent by Mr. J. F. Schmalzried, of North Platte, Neb., is the Bryophyllum calycinum. It is a tropical plant, occurring abundantly in the West Indies and in Madagascar, Mauritius, etc. It grows in dry situations, often in clefts of the rocks, and a closely related species is found covering the stone fences in Jamaica, producing a rather pretty effect, seeing that the leaves frequently become bright yellow and purplish. The plant really belongs to the leek family, Crassulaceae, of which the common house leek furnishes a familiar example, and the fleshy leaves bud and root readily when stuck into the soil. In Mauritius the plant is said to be used as a fomentation or poultice in intestinal complaints. It is not uncommonly grown in greenhouses for the rather odd panicles or flowers.—Answered by Professor C. V. Riley.

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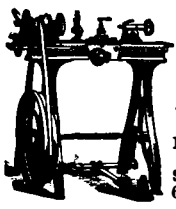

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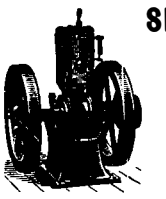

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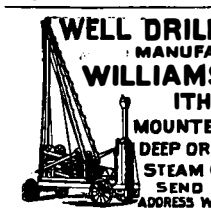

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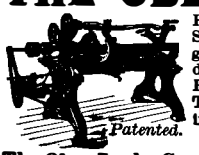

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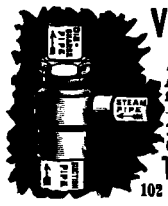

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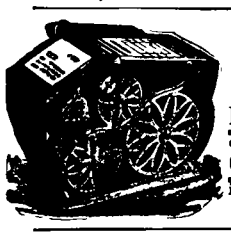

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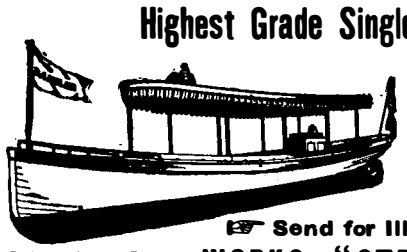

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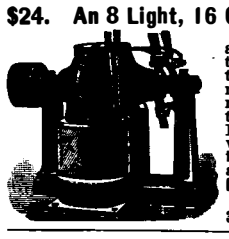

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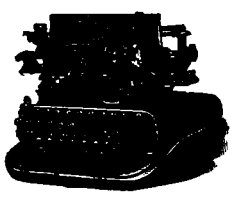

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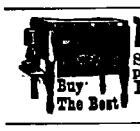

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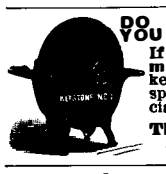

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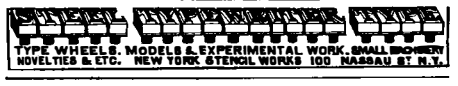

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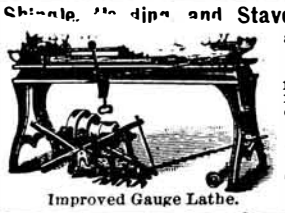

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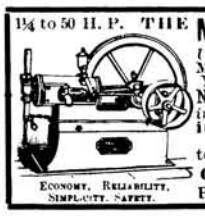

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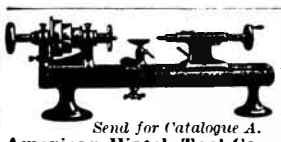

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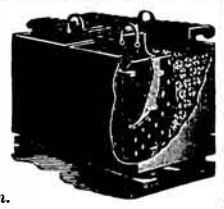

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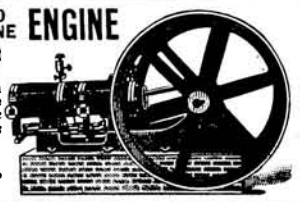

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